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JOURNAL OF THE AMERICAN STATISTICAL ASSOCIATION

# STATISTICAL IMPLICATIONS OF THE SOCIAL SECURITY PROGRAM

BY MEREDITH B. GIVENS, *Social Science Research Council*

Statistics are a necessary adjunct of administration and their use is indispensable to the work of government. This is well illustrated by the importance of both statistical and accounting controls for effective administration of the Social Security Act. Almost the entire population will be affected in some way by this program when it is in full operation. At the outset it is necessary to estimate the probable financial load and the approximate numbers of persons affected. In attempting such estimates the unsatisfactory nature of available information and the imperative need for the prompt creation of more adequate data is evident.

It is too early to discuss in full detail the statistical work which will be essential to the efficient administration of state and Federal social security laws. Nevertheless, statisticians may find it worth while to consider some of the broad implications for statistics which are suggested in the following discussion.

However the exact scope of work may be determined, the program will add new and rich content to the storehouse of data pertaining to the life and conditions of the people and the means for their improvement. A broad plan of statistical reporting, research, and forecasting of a high order will be required to support the direct needs of administration and to furnish guides for development and further planning. Care must be taken that the statistical set-up shall be soundly conceived and wholly useful, while placing a minimum burden on individual respondents and reporting agencies. With minor exceptions, the statistical materials of the new program will be secured automatically from the routine administrative records which will be kept incident to the collection of contributions and taxes, the registration of eligibles, the payment of benefits and other phases of administration.

### NEW PROGRAM WILL FILL GAPS

Up to the present this country has lacked precise information concerning unemployment and dependency. The most painstaking estimates of the volume of unemployment in the United States have been notoriously unreliable. Similarly, the relief and welfare field has been irregularly and inadequately covered. A composite picture of the volume and character of public and private relief would be of inestimable value for administration and planning, in the states and localities and on the national scene, but hitherto no facilities have existed for the development and coordination of information in this broad field.

The Social Security Act provides an outstanding opportunity for remedying some of these statistical deficiences. To fill these gaps, in fact, will be essential for the operation of the program itself. Chiefly as a by-product of administration, comprehensive statistical information concerning employment and unemployment will gradually develop under the extensive registration and reporting system which will be required. The administrative statistics, of course, will be limited by the scope of the legislation, and will provide no information concerning those employed and unemployed persons who are not eligible for the benefits of the program. Thus a special need exists for the extension of statistical services and voluntary reporting to supplement the coverage of the administrative data.

Current demographic data also will be obtained under the old age benefits program. In all probability, the Social Security Board will find it desirable to consolidate the statistics of relief and welfare, both public and private, to ascertain the relative lifting power and costs of the various aspects of the governmental program, Federal, state and local, and the role of the various categories of private relief. Statistically, these matters have long remained in the twilight zone of uncertainty. The work of the Board's research and planning division in these fields may be expected to go far toward filling wide and long-deplored gaps in our social statistics.

### DIVERSITY OF INTERESTS TO BE COORDINATED

The Social Security Act delegates direct administrative responsibility to five principal Federal agencies. The cooperation of several hundred state agencies will be required, and the work of many other agencies will be less directly but seriously affected. In addition to the Social Security Board itself, a considerable number of Federal organizations will be concerned with statistical aspects of the program; these

include the Division of Standards and Research of the U. S. Employment Service, the Bureau of Labor Statistics, the Children's Bureau and other divisions of the Department of Labor, the Bureau of the Census, the Federal Emergency Relief Administration, the Works Progress Administration, the Railroad Retirement Board, the Interstate Commerce Commission, the Office of the Coordinator of Railroad Transportation, the Bureau of Foreign and Domestic Commerce, the Office of Education, the Bureau of Home Economics, the Rural Resettlement Administration, the Veterans' Administration, the Federal Power Commission, the Petroleum Labor Board, the U. S. Public Health Service, the Bureau of Internal Revenue and other divisions of the Treasury Department, and the Post Office Department. The research and planning division of the new Board must give attention to the interests and needs of these and other agencies. As the focal agency for the coordination and general analysis of all materials relating to social security, the Board's position will be strategic.[1]

This situation provides a great opportunity for the creation of a coherent and coordinated system. It is also fraught with serious dangers unless procedures and techniques are thought out carefully from the outset. The scope of the program and the wide powers of the Board will justify the maintenance of the statistical services necessary to provide a blended national picture. On the other hand, the statistical plan can be deficient by doing too little, therefore failing to provide the necessary controls and guidance—or the multiplicity of Federal and state agencies may lead to a tremendous welter of oddly assorted and unrelated reporting. This last danger is by all odds to be prevented, and its avoidance will require leadership and foresight of a high order. In this, the assistance of the Central Statistical Board should prove exceedingly helpful.

## SCOPE AND ALLOCATION OF WORK

On the statistical side the new legislation vests ample authority in the Social Security Board. It is specified that the Board "shall have the duty of studying and making recommendations as to the most effective methods of providing economic security through social insurance, and as to legislation and matters of administrative policy concerning old age pensions, unemployment compensation, accident compensation, and related subjects." Full reports must be submitted to Congress. The Federal old age benefits program, which will be administered by the Social Security Board itself, must rest upon sound actuarial and statistical foundations, and the Board must make direct

[1] Cf. Central Statistical Board, *First Annual Report*, p. 9.

provision for the needed basic data. Under the several titles of the Act the Board may require from aided state agencies such reports as may be necessary for its purposes. In the case of unemployment compensation, the Act provides that states must render "such reports, in such form, and containing such information, as the Board may from time to time require"; [2] similar powers are specified in connection with aid to dependent children, old age and blind assistance, covering state plans which may qualify for the receipt of Federal grants-in-aid. Wise exercise of responsibility for granting or withholding Federal funds will require close scrutiny and appraisal of state administration, and this appraisal, in turn, will depend in part on the collection and analysis of statistical evidence.

Powers of review and appraisal similar to those of the Social Security Board have been given to the Childrens' Bureau of the Department of Labor, to be exercised in the administration of grants to the states for maternal and child welfare, services for crippled children, and other child welfare services provided under the Act. In statistical matters the appropriate line of cooperation between the Board and the Childrens' Bureau remains, of course, to be worked out. In the administration of taxes with respect to employment,[3] the Bureau of Internal Revenue will develop extensive records pertaining to their sources and volume. Some extension of the statistical services of the Office of Education and the Public Health Service may be required in connection with the expanded work of vocational rehabilitation and public health provided for under the Act.

The Social Security Act provides for an admixture of Federal and state administration. Under its provisions the work of the Board will be both administrative and advisory in character. Only the contributory old age benefits feature will be operated directly by Federal authority. Administration of all other features of the program will devolve on the cooperating states. The Federal authority, however, must scrutinize state legislation and its administration to make sure of compliance with minimum standards to be required by the Board. Statistical information and reports from the states will be needed in appraising the efficient operation of the various state plans.[4] Account-

[2] Further, the states must be prepared to make available "to any agency of the United States charged with the administration of public works or assistance through public employment, the name, address, ordinary occupation and employment status of each recipient of unemployment compensation, and a statement of such recipient's rights to further compensation under such law." *Social Security Act*, Title III, Sec. 303 (7).

[3] *Social Security Act*, Titles VIII and IX.

[4] The various titles of the Social Security Act provide that the Board shall approve state laws only if they provide that there are such "methods of administration (other than those relating to selections, tenure of office, and compensation of personnel) as are found by the Board to be necessary for the efficient operation of the laws." Such a provision is found in one form or another in the old age assistance, aid to dependent children, and blind assist-

ing procedures and statistical reports must be comparable to afford interstate comparisons and provide the elements of a composite national picture.

However diverse the origin and ultimate uses of required reports, it is imperative that a coordinated plan for collecting them from a given group of respondents shall be developed. The statistical demands on industry should be adapted as closely as possible to the internal records and requirements of business. Nationally operated concerns will confront a diversity of state laws, and efforts to harmonize the various procedures will be important to large business interests.

A minimum program for statistical reports relating to the social insurances, relief and welfare should assure a comprehensive and unified presentation of the total situation in the country, despite the persistence of local differences in legislation and procedure. A comprehensive picture has never existed in the welfare field, while the social insurances, of course, have been undeveloped in this country. The registration of eligibles through the employment exchanges or other authorized registration offices should furnish an integrated system of records which will readily yield such summaries and cross-tabulations as may be needed. It will be necessary to assemble registration data by firms, matching the employers' reports with the employee's cards.

The Bureau of Internal Revenue, in collecting payroll taxes from employers under two different titles of the Social Security Act, should consider a consolidated tax return, to contain all of the information to be required from a single employer.

The immediate legislative problems which confront the Board will gradually be replaced by administrative problems, and as this takes place the advisory and service functions of the Board will expand steadily. The degree of leadership exercised by the Board and the effectiveness of its advisory functions will depend upon the imagination and technical capacity of staff and the sheer merit of its work. To support this the informational facilities of the Board must be much more extensive than the minimum prescribed by the strict requirements of administration.

## SUBJECT MATTER FIELDS

The huge statistical problems of the program will fall chiefly within

ance titles of the Act, as well as in the title dealing with the payment of Federal grants for the administration of state unemployment compensation laws. Thus the Social Security Board must evaluate "such methods of administration" not only by setting standards by which administration is to be judged, but by the utilization of statistical information and reports from the states as may be required to determine what will be "necessary for efficient operation."

three principal subject matter fields—population and mortality, employment and the labor market, relief and dependency. In addition, the Board will be concerned with the investigation and study of workmen's compensation and accident prevention, medicine and public health, and generally with the social, economic and financial effects and implications of its program. Thus the Board will have a very substantial interest in the entire flow of statistical data beyond the scope of the original reporting which will be strictly within its special sphere of influence.

Population statistics, of course, are fundamental to the planning of the various protections covered by the social security program. It is necessary to determine the numbers, location and characteristics of the groups affected. Age and mortality statistics acquire a new importance when billions are to be diverted from the national income into reservoirs of purchasing power to be used for deferred payments to the aged. Decennial census statistics will no longer suffice in a field which has advanced from the realm of research and planning into that of practical politics and administration. Later, if health hazards are segregated from other risks for special handling through medical or health insurance, new demands will be made on the informational services in these fields. Precise and current determination of the number and distribution of dependents and handicapped becomes a matter of national concern, rather than a matter chiefly of local interest as in the past.

## REGISTRATION DATA

A principal contact point between the social security program and the population affected will be the local public employment office.[5] It seems probable that these offices will be used for registration purposes for both the Federal old age benefits and for unemployment compensation. Registration of all eligibles at these offices and national clearance of registration data will provide the most comprehensive current information concerning the population that has ever been available in this country. Registrants, of course, will include only the employables or gainfully occupied, the aged and the handicapped, and such others as may be entitled to participation in the benefits provided by the legislation. To determine the aggregate state of affairs, however, careful quantitative estimates concerning the

[5] Under Title III of the Social Security Act the Board may authorize the payment of unemployment compensation through public employment offices "or such other agencies as the Board may approve." While a loophole is thus provided for the designation of agencies other than the employment exchanges, it seems unlikely that other agencies will be used to any extent.

numbers and condition of those fractions of the population not covered by the social security legislation will be needed. This requires a close meshing of Census schedules and techniques with the far-reaching procedures to be devised under the security program.

The intimate nature of the statistical requirements which may be required is illustrated by the provisions of the Massachusetts Act providing for the establishment and administration of unemployment compensation. Under section 43 (a) of the Act "Every employer, whether subject to this chapter or not, shall keep true and accurate records of all persons employed by him, showing the weekly hours worked for him by each employee, the weekly wages paid by him to each employee, the number of employees laid off, and the reason and duration of such lay-off. Such records shall be open to inspection by the commission or its authorized representative at any reasonable time. The commission may require from any employer such reports on wages, hours, employment, unemployment and related matters concerning his employees as the commission deems necessary to the effective administration of this chapter, and every employer shall fully, correctly and promptly furnish the commission all information required by it to carry out the purposes and provisions of this chapter."

Beyond essential Federal requirements the registration problem will be complicated, of course, by diversities in state legislation. Employee registration will present special features, for example, under the five state unemployment compensation laws, which have provisions for the payment of employee contributions.[6] Diversity of procedure itself, given a minimum Federal program, will facilitate experiments which should be watched with interest by statisticians.

A single registration scheme can doubtless serve the unemployment compensation and contributory old age benefits plans. Thus an eligible individual will receive a registration number to serve as his identification in qualifying for a Federal old age benefit or state unemployment compensation. The system of numbering must provide for following the individual in both intrastate and interstate migration, and preferably a single number should follow each person throughout life. Allowance for growth and shifts in population is important if the numbering system is to proceed indefinitely without need for serious readjustment. Preparation of an understandable, workable system and early negotiations with the states will be required.

Reports from employers will supplement the employment office rec-

[6] These states are Alabama, California, Massachusetts, New Hampshire, and Washington. The taxes in all of these states are effective in 1936, with the exception of those in Massachusetts, which become effective in the year 1937.

ords. In New York, for example, weekly reports will be received from all employers in the state subject to the Act, covering the numbers and compensation of all employees. Such reports, when combined with the registration data, will provide comprehensive information concerning the volume and distribution of employment and unemployment, more inclusive and accurate than ever before available. Such information is indispensable in following the individual and checking on the volume, distribution and regularity of employment.

It is possible that this new program foreshadows an inclusive system of registration in the United States. The American prejudice against universal registration has been firmly and deeply rooted. The freedom of the individual has in some way been associated with his right to disappear and lose his identity, to shift about at will without being followed or traced by public authority as in the older countries of Europe. This freedom is a characteristic of the frontier and of an undeveloped or expanding national economy. The social security legislation itself is an evidence of industrial and economic maturity and the recession of the economic frontier in the United States. With this coming of age it must be recognized that the freedom of an undeveloped country can be retained only at a price. The individual's claims on society's protection under a program of social security cannot be developed and conserved except with the acceptance of a pervasive system of individual histories and identification.

At the beginning registration data probably will cover the individual alone, but the cards can be made to yield demographic data of the utmost importance in the study of population, employment, and economic welfare. It is possible that a gradual recognition of the wider uses of registration data may lead to expansion of the items to serve broader requirements of social inquiry. Undue concessions in this direction should be avoided at the outset, until the immediate values of the social security legislation shall be firmly established in the popular mind.

The facts of internal migration are likely to be available for the first time by means of the registration system. Comprehensive coverage, induced by the payment of benefits, is essential for the efficient regional and national clearance of the labor market in an organized program for the maximization of employment. To obtain the greatest possible employment at any given level of business conditions requires a condition of greatest fluidity in the labor market. Both placement and unemployment compensation must operate through efficient local employment exchanges. Local, regional and national clearance of statistics of openings, applications, referrals and placements is the

responsibility of the U. S. Employment Service. Studies of the duration of unemployment, indispensable to provide an actuarial basis for unemployment benefits, must be built upon analysis of the registration data. Experiments with new and more workable occupational classifications are now under way, looking toward the evolution of new techniques and a new terminology based upon actual similarities of work rather than upon the accidents and inaccuracies of traditional terms.

### OCCUPATIONAL AND INDUSTRIAL CLASSIFICATIONS

State unemployment authorities must maintain a currently comprehensive picture of the volume of employment and unemployment within their jurisdictions. It is important that the statistics be broken down by both occupational and industrial groupings. The summarization of employment data according to occupational groups will be valuable for placement and training, and will aid in planning the most effective use of the human resources of the nation. These groupings will enable the community to predict more accurately the rise and decline of employment opportunities, the obsolescence of old skills and their displacement, and the need for new capacities and new types of training. Classification of the same data by industries is necessary for study of the industrial causes of unemployment. Important developmental work in devising and testing new occupational specifications and classifications is now under way in the U. S. Employment Service.[7] Further, work must be done on industrial as well as occupational classifications, and it is hoped that the Social Security Board can contribute a decisive influence to support needed cooperative work in this field.

### EFFECT ON PRESENT SYSTEMS OF REPORTING

It seems probable that the present voluntary system of employment and payroll reporting will be rendered obsolete with the advent of unemployment insurance. The present system, developed by the United States Bureau of Labor Statistics with the cooperation of various state bureaus, is unique among the nations of the world. Its coverage, recently extended in important ways, is impressive, especially in view of its wholly voluntary nature. Within the states which enact unemployment compensation laws, however, the present reporting system on a sampling basis undoubtedly will be largely replaced by the system of administrative records incident to the new legislation. To maintain the continuity of existing series should not be difficult,

[7] See the note on p. 738 of this issue of the JOURNAL.

however, if the present series are carefully spliced with comparable and more inclusive reports under the compulsory systems.

Whether comprehensive data can be released promptly, or whether the sampling method must continue in combination with more universal reporting, is a matter to be determined by experience and experiment. In any case, it must be remembered that the coverage of unemployment compensation laws will not be universal, and hence the state bureaus and the U. S. Bureau of Labor Statistics may profitably concentrate special attention upon the development of employment and unemployment information for those groups not included in the legislation. The logic of the situation appears to point toward the possible transfer of important functions of the state bureaus of labor statistics, if not the absorption of the bureaus themselves, into the new unemployment compensation authorities. Within the Federal Govern nment, close cooperation between the appropriate divisions of the Bureau of Labor Statistics, the Employment Service, and the Social Security Board must be worked out.

On the relief and welfare side, similar opportunities for expansion and coordination are presented. Three Federal agencies are most directly concerned—the Childrens' Bureau, the Federal Emergency Relief Administration, and the Social Security Board. The well-developed data from private agencies now gathered by the Childrens' Bureau and the broad information on public relief now reported to the Federal relief authorities should provide a good basis for a permanent plan.

The far-reaching implications, the many opportunities, and some dangers in the statistical phases of the social security program have been touched lightly in the foregoing discussion. It is clear that existing allocations of work and some vested interests will be disturbed as the program takes shape. So long as the Act remains in effect, statisticians in business and government can support several general objectives, irrespective of their attitudes toward the Social Security Act in its entirety. First, they will wish to see established and actually put to use a statistical system which will contribute all that statistical science can to the efficient administration of the Act. Second, they will be interested in by-product statistics of immense value for general social inquiry, which may be secured from such a system without adding materially to the burdens of collection and tabulation. Third, they will be concerned that these statistics be collected and compiled by procedures which will minimize the demands on employers and other respondents and utilize existing systems of reporting, supplanting

them only when necessary. Finally, they will seek the extension of statistics in this field to facilitate the control of economic hazards and the attainment of a greater degree of stability in employment, industry, and trade.

# CORPORATE EARNINGS, 1929–31: SUBGROUPS IN NON-MANUFACTURING INDUSTRIES

By Solomon Fabricant, *National Bureau of Economic Research*

Until very recently satisfactory data relating to the earnings of corporations engaged in fields other than manufacturing and public utilities were scattered and few. This was especially true of subdivisions of the service and finance groups. The data published by the Treasury Department in *Statistics of Income* cover mainly broad industrial divisions, groups so wide that their homogeneity is necessarily in question. The Treasury figures relating to subgroups are confined to statutory net income and to gross income, unsatisfactory materials for comparing the earning power of corporations in different industries, and also limited in value for use in time comparisons of profits within the service, finance and utilities groups.

It is possible to present now, however, for subgroups in the non-manufacturing divisions, and for 1929–31, rates of return on book value of stockholders' capital, as well as other figures bearing on the question of profitability. Besides revealing the earnings positions of the subgroups in these little known fields of enterprise, these data throw light on the adequacy with which the major-group rates of return portray the earning power of the various subgroups comprehended by the major divisions. The rates of earnings of only the major groups are available for years prior to 1929.

No extended comment is made in the present paper. The task of comparison with earnings in other industrial fields, and with data covering other aspects of operations in these industries, remains to be done. Presentation is confined to the basic data, and discussion is limited to some of the qualifications surrounding the derived statistics.

## THE ORIGINAL DATA

The ratios and other derived statistics presented in this paper are based on special tabulations of corporate income tax reports. These tabulations were prepared by the Statistical Section of the U. S. Bureau of Internal Revenue for use in the national-income study of the Department of Commerce carried on in cooperation with the National Bureau of Economic Research.

The profits figures and other income-account data are published in

"Appendix B" of *National Income, 1929–32*.[1] These cover the years 1929–31 inclusive, and relate to subgroups of the following industrial divisions: Mining and quarrying, Transportation and other public utilities, Trade, Service, and Finance. Corresponding data on bonded debt and mortgages and capital stock (for 1930 and 1931 only) appear in "Appendix C" of the same publication. Figures as to surplus and undivided profits and deficits have not hitherto been published. They are given, for the years available (1930–32), at the end of this paper by courtesy of Mr. Edward White, chief of the Statistical Section of the Bureau of Internal Revenue.[2]

Owing to the absence of 1929 data, it has been necessary to estimate the capital items of that year. This has been done by using the depreciation deductions given in "Appendix B" of *National Income, 1929–32*. The ratio of net worth in 1930 to depreciation charges in that year was multiplied by depreciation charges in 1929. The resulting figure for each subgroup was reduced by the proportion necessary to make the total net worth of the subgroups equal to the net worth of the appropriate major group as reported in *Statistics of Income for 1929*. To check the results in certain cases similar use was made of "domestic taxes paid". While subject to some degree of error, it is felt that the estimates are sufficiently reliable to warrant their use.

No adjustment has been made of the data on capital, which relate only to corporations filing balance sheets. The profits and other figures are those of all corporations in the several groups. For the year 1931, the following figures may be presented to justify this procedure of ignoring the capital of the companies not reporting balance sheets. (These figures are available only for the major groups.)

| | Total compiled receipts of corporations reporting balance sheets, as a percentage of total compiled receipts of all corporations |
|---|---|
| Mining | 97.9 |
| Service | 94.7 |
| Trade | 96.5 |
| Finance | 94.0 |
| Public utilities | 99.1 |

The Bureau of Internal Revenue, in making the various original data available, directs attention to the fact that the industrial classification is based on the predominant business of nonaffiliated cor-

[1] Senate Document No. 124, 73d Congress, 2nd Sess., 1934.

[2] Data for certain of the residual groups ("other minerals," "other service," and "other finance") have been obtained by subtraction of the data for the given subgroups from the figures relating to the major divisions, the latter being taken from the annual *Statistics of Income* for 1929–31. Since the group "other finance" consists solely of banks, with an unimportant exception in 1929, it has been so labeled.

porations or of groups of affiliated corporations filing a single return. Because of possible changes in the classification of individual companies and of variation in the number of consolidated returns, year-to-year comparisons of the figures as they stand are subject to error. Any error tends to be greater in the very narrow groups. Large changes in capital, explicable chiefly on the basis of shifts in classification, are noticeable in certain industries, as follows:

| | | |
|---|---|---|
| Coal, anthracite | Decline | 1929–30 |
| Aerial transportation | Rise | " |
| Gas companies | " | " |
| Radio broadcasting | " | " |
| " " | Decline | 1930–31 |
| Other public utilities | " | " |
| Other trade | " | 1929–30 |
| Professional service | " | 1930–31 |
| Business service | " | " |
| Other service | Rise | " |
| Brokers, investment bankers, and investment trusts | Decline | " |
| Real estate | Rise | 1929–30 |
| Insurance companies, other than life | " | " |
| " " " " " | Decline | 1930–31 |

However, since the earnings ratios used here are derived from data relating to the same year, errors due to shifts in classification tend to become minimized, and the ratios may be considered as fairly comparable from year to year.

### THE RATE OF EARNINGS ON NET WORTH

Table I contains, for the years 1929–31, percentage ratios of net income to capitalization (that is, compiled net profits after tax as a percentage of book value of net worth—the latter being measured by capital stock, preferred and common, plus surplus minus deficit). Figures for 1932 are also given for the major industrial divisions. A column giving the amount of capitalization in 1930 has been added, to indicate the relative importance of each subgroup. The compilation in Table II will facilitate study of the figures.

The large rate in 1929 in the case of radio broadcasting is outstanding. While the 1929 capitalization is of course estimated, what supplementary evidence there is in the Treasury data appears to support the general accuracy of the figure: for example, only one-fourth of the 1929 compiled net profits of this group was disbursed in the form of dividends to stockholders. The large shift in the rate of return from 1929 to 1930 is probably due to the transfer of several important companies to this group. (As already pointed out, this possibility must be taken into account in considering the changes from year to year in all the narrow groups given here.)

The rather low rates of return indicated for the mining groups in

1929 are the result, in part, of the methods of computing depletion charges.[3] The maximum effect on the earning ratios is suggested by the following tabulation of the percentage ratio of depletion charges to capitalization, for the years 1929–31:

| | 1929 | 1930 | 1931 |
|---|---|---|---|
| Mining and quarrying, total | 2.8 | 2.4 | 1.5 |
| Metal mining | 2.7 | 2.3 | 1.4 |
| Coal, anthracite | 1.1 | 1.5 | 1.3 |
| Coal, bituminous | 1.2 | 1.1 | 0.8 |
| Oil and gas | 5.2 | 4.7 | 2.7 |
| Other minerals | 1.8 | 1.4 | 1.0 |

In the case of real estate and realty holding companies the low rate of return may be ascribed, to some extent, to the nominal character of many of these enterprises. Many of the realty companies are designed merely to hold real estate and to avoid liability on leases, and their income and outgo thus tend to cancel one another.[4]

Also requiring mention is the inclusion of profits and losses on the sale of capital assets in the present figures on net income. Some of these sales, which consist chiefly of stocks and bonds, are made for the purpose of establishing tax-reducing losses. This procedure amounts to the use of an accounting method involving the carrying of some capital assets at market value. Since in most business enterprises they are carried at cost, this tends to complicate industrial comparisons of profitability. For comparison, therefore, ratios of net income to capitalization may be given excluding profit or loss on sale of capital assets. As such sales occur chiefly in the financial groups the figures following are confined to these groups. (Data for 1929 are not available.)

| | Net income (excluding profit and loss on sale of capital assets) as a percentage of capitalization | |
|---|---|---|
| Group | 1930 | 1931 |
| Brokers, investment bankers and investment trusts | –3.3 | –3.5 |
| Real estate | –0.7 | –2.3 |
| Insurance companies other than life | 0.9 | 0.6 |
| Loan companies, etc. | 4.5 | 3.2 |
| Banks | 4.5 | 0.4 |

It must be remembered that duplications of capital have not been eliminated. Railroad stocks held by investment trusts, for example, thus appear in two places in Table II, under railroads and in the

[3] See R. C. Epstein, *Industrial Profits in the United States*, 1934, National Bureau of Economic Research, pp. 327–8.

[4] Evidence supporting this assertion is obtained by an examination of the amount of compensation of officers per company. For the realty group this is one of the smallest, only $1,900 per corporation in 1929.

capitalization of the finance group. Further, the income of companies holding stocks tends to be more stable than that of the companies whose stocks are held to the extent that dividends are paid out of surplus, rather than out of current earnings.

TABLE I

RATES OF EARNINGS OF CORPORATIONS IN THE UNITED STATES, 1929-1932
SUBGROUPS IN NON-MANUFACTURING INDUSTRIES

| Group[1] | Capitalization 1930 ($1,000,000) | Net income as a percentage of capitalization | | | | |
|---|---|---|---|---|---|---|
| | | 1929* | 1930 | 1931 | 1932 | Decline 1929-31 |
| *Mining and quarrying* | 7,751 | 2.9 | — 0.0 | — 3.0 | — 2.9 | 5.9 |
| Metal mining | 2,621 | 5.8 | — 0.5 | — 2.8 | | 8.6 |
| Coal, anthracite | 421 | 1.1 | 3.8 | 1.3 | | 0.2[3] |
| Coal, bituminous | 1,429 | — 0.5 | — 2.6 | — 3.3 | | 2.8 |
| Oil and gas | 1,622 | 1.6 | 0.5 | — 6.8 | | 8.4 |
| Other minerals | 1,658 | 3.3 | 1.4 | — 0.6 | | 3.9 |
| *Transportation and other public utilities* | 40,775 | 6.5 | 4.0 | 2.3 | 0.6 | 4.2 |
| Water transportation | 571 | 7.6 | 2.3 | — 1.9 | | 9.5 |
| Aerial transportation | 141 | — 6.3 | —13.4 | —10.0 | | 3.7 |
| Autobus and taxi | 177 | 3.2 | — 1.8 | — 2.4 | | 5.6 |
| Steam railroads | 15,304 | 5.8 | 2.8 | — 0.4 | | 6.2 |
| Electric railways | 2,659 | 4.2 | 4.1 | 2.1 | | 2.1 |
| Electric light and power | 11,013 | 6.8 | 4.0 | 3.4 | | 3.4 |
| Gas companies | 2,266 | 6.1 | 5.0 | 4.2 | | 1.9 |
| Cartage and storage | 687 | 7.2 | 2.9 | 1.6 | | 5.6 |
| Telephone and telegraph | 4,040 | 12.4 | 9.4 | 8.0 | | 4.4 |
| Radio broadcasting | 143 | 24.9 | — 4.2 | — 4.1 | | 29.0 |
| Water companies | 506 | 6.9 | 3.3 | 5.2 | | 1.7 |
| Other public utilities | 3,270 | 5.0 | 3.8 | 2.4 | | 2.6 |
| *Trade* | 12,793 | 5.1 | — 0.5 | — 4.8 | — 7.7 | 9.9 |
| Wholesale | 3,797 | 4.8 | — 0.9 | — 5.9 | | 10.7 |
| Retail | 6,307 | 5.0 | — 0.5 | — 4.0 | | 9.0 |
| Wholesale and retail | 1,556 | 6.2 | — 0.1 | — 4.4 | | 10.6 |
| Commission | 569 | 6.5 | — 2.0 | — 3.5 | | 10.0 |
| Other trade | 564 | 4.2 | — 2.2 | — 9.3 | | 13.5 |
| *Service* | 4,289 | 4.3 | 2.0 | — 2.6 | —10.7 | 6.9 |
| Domestic | 1,254 | 1.3 | — 2.3 | — 7.6 | | 8.9 |
| Amusements | 1,060 | 5.8 | 4.6 | — 1.1 | | 6.9 |
| Professional | 414 | 4.6 | 1.8 | — 3.2 | | 7.8 |
| Business | 1,371 | 5.4 | 4.1 | 2.0 | | 3.4 |
| Other service | 191 | 4.1 | 1.3 | — 1.7 | | 5.8 |
| *Finance, excluding life insurance companies*[2] | 39,574 | 5.7 | 1.8 | — 2.0 | — 4.3 | 7.7 |
| Brokers, investment bankers and investment trusts | 4,435 | 3.9 | — 5.8 | —14.3 | | 18.2 |
| Real estate | 8,132 | 2.0 | — 0.5 | — 3.7 | | 5.7 |
| Insurance companies, other than life | 2,122 | 9.5 | 0.2 | — 3.6 | | 13.1 |
| Loan companies, etc. | 15,786 | 6.4 | 3.7 | 0.4 | | 6.0 |
| Banks | 9,098 | 7.9 | 4.7 | 1.2 | | 6.7 |

* Estimated.
[1] Fuller titles of the subgroups appear in the Appendix Table.
[2] Life insurance companies have been omitted because their income is partially tax-exempt.
[3] Rise.

Only earnings on stockholders' net worth have been tabulated here. Yet in many industries a considerable fraction of invested capital takes the form of long-term indebtedness. If total profits, including interest paid on bonds and mortgages, be in question, it is necessary to expand both numerator and denominator of the earnings ratio to include long-term debt and interest paid thereon. While the Treas-

ury Department data do not show these interest payments separately, it is possible to estimate them with a relatively small degree of error. The data on long-term debt are available in the publications mentioned above.[5]

TABLE II
FREQUENCY DISTRIBUTIONS OF RATES OF EARNINGS, 1929 AND 1931, AND OF CHANGES IN RATES OF EARNINGS, 1929-31, BY INDUSTRIAL GROUPS
(The rate of earnings is net income as a percentage of capitalization; the ratio of each subgroup counts as one item.)

| Percentage of capitalization | Mining and quarrying | Transportation and other public utilities | Trade | Service | Finance, excluding life insurance companies | Total (5 groups) |
|---|---|---|---|---|---|---|
| *1929* | | | | | | |
| Under 0.0 | 1 | 1 | | | | 2 |
| 0.0 to 2.9 | 2 | | | 1 | 1 | 4 |
| 3.0 to 5.9 | 2 | 4 | 3 | 4 | 1 | 14 |
| 6.0 to 8.9 | | 5 | 2 | | 2 | 9 |
| 9.0 to 11.9 | | | | | 1 | 1 |
| 12.0 and over | | 2 | | | | 2 |
| *1931* | | | | | | |
| Under —6.0 | 1 | 1 | 1 | 1 | 1 | 5 |
| —6.0 to —3.1 | 1 | 1 | 4 | 1 | 2 | 9 |
| —3.0 to —0.1 | 2 | 3 | | 2 | | 7 |
| 0.0 to 2.9 | 1 | 3 | | 1 | 2 | 7 |
| 3.0 to 5.9 | | 3 | | | | 3 |
| 6.0 to 8.9 | | 1 | | | | 1 |
| *Change, 1929-31* | | | | | | |
| Under —12.0 | | 1 | 1 | | 2 | 4 |
| —12.0 to —9.1 | | 1 | 3 | | | 4 |
| — 9.0 to —6.1 | 2 | 1 | 1 | 3 | 1 | 8 |
| — 6.0 to —3.1 | 1 | 5 | | 2 | 2 | 10 |
| — 3.0 to —0.1 | 1 | 4 | | | | 5 |
| 0.0 and over | 1 | | | | | 1 |

## THE EARNINGS OF MANAGEMENT

The distinction between earnings of management and profits accruing to invested capital, always a rough one, is made more vague by efforts to avoid tax liability. Further, it is especially in the industries considered here, such as trade and service, that the personal element assumes great importance and the money-flows to managers bulk large. A study of the profitability of corporations engaged in these industries may not neglect the earnings of officers.

"Compensation of officers" as reported for tax purposes is taken to represent these payments. Included are bonuses as well as salaries. Table III presents compensation of officers in 1930 as a percentage of net worth in that year. Average size of company (measured by net worth in 1930), one of the elements affecting these payments in their importance relative to net income, is also given. Figures for other years are much the same as those for 1930 and have therefore been

[5] See *Bulletin 55*, April 11, 1935, National Bureau of Economic Research, for ratios of "total profit" to "total capital". The figures there given are for major industrial divisions only.

omitted. Supplementary figures in the table are, in relatives on the 1929 base, compensation of officers of the major industrial groups.

TABLE III
EARNINGS OF MANAGEMENT IN CORPORATIONS IN THE UNITED STATES, 1929-1932
SUBGROUPS IN NON-MANUFACTURING INDUSTRIES

| Group | Capitalization per company, 1930 ($1,000) | Compensation of officers | | | |
|---|---|---|---|---|---|
| | | As a percentage of capitalization, 1930 | In relative form (1929=100) | | |
| | | | 1930 | 1931 | 1932 |
| *Mining and quarrying* | 773 | 0.7 | 90.3 | 79.9 | 68.2 |
| Metal mining | 4,200 | 0.2 | | | |
| Coal, anthracite | 4,255 | 0.3 | | | |
| Coal, bituminous | 728 | 1.0 | | | |
| Oil and gas | 512 | 0.7 | | | |
| Other minerals | 397 | 1.1 | | | |
| *Transportation and other public utilities* | 2,364 | 0.3 | 95.7 | 88.5 | 78.1 |
| Water transportation | 385 | 1.9 | | | |
| Aerial transportation | 282 | 1.2 | | | |
| Autobus and taxi | 102 | 4.9 | | | |
| Steam railroads | 29,206 | 0.1 | | | |
| Electric railways | 3,870 | 0.2 | | | |
| Electric light and power | 13,732 | 0.1 | | | |
| Gas companies | 5,295 | 0.2 | | | |
| Cartage and storage | 100 | 5.3 | | | |
| Telephone and telegraph | 2,013 | 0.1 | | | |
| Radio broadcasting | 528 | 2.0 | | | |
| Water companies | 494 | 0.4 | | | |
| Other public utilities | 3,649 | 0.2 | | | |
| *Trade* | 107 | 6.9 | 92.8 | 81.0 | 64.4 |
| Wholesale | 170 | 6.6 | | | |
| Retail | 89 | 6.7 | | | |
| Wholesale and retail | 158 | 5.9 | | | |
| Commission | 92 | 11.2 | | | |
| Other trade | 54 | 10.9 | | | |
| *Service* | 142 | 5.0 | 99.0 | 88.2 | 71.3 |
| Domestic | 110 | 6.1 | | | |
| Amusements | 182 | 2.4 | | | |
| Professional | 82 | 9.8 | | | |
| Business | 300 | 4.0 | | | |
| Other service | 55 | 10.0 | | | |
| *Finance, excluding life insurance companies* | 348 | 1.5 | 94.8 | 79.3 | 63.0 |
| Brokers, investment bankers and investment trusts | 1,075 | 1.0 | | | |
| Real estate | 128 | 1.6 | | | |
| Insurance companies, other than life | 1,729 | 1.2 | | | |
| Loan companies, etc | 677 | 0.8 | | | |
| Banks | 419 | 2.9 | | | |

## REPRESENTATIVENESS OF MAJOR-GROUP AVERAGES

The large dispersion of the subgroup ratios about their weighted arithmetic means is apparent from Table II. Despite the width of the class intervals, the degree of variation appears large. Yet some clustering is noticeable when different major industries are compared.

The data are not sufficiently detailed to bear the weight of a refined statistical apparatus. However, we may draw the following tentative conclusion. With reference to most of the major groupings considered in the present paper, it appears that these broad classifications have some empirical basis indicating homogeneity in respect of factors influencing profit levels and changes therein. That many in-

dividual factors are involved is apparent. But the assumption that several general influences of some considerable weight operating upon all the subgroups comprehended by a major industrial division do exist, appears to be warranted.

## CONCLUDING NOTE

There have been presented rates of return on stockholders' equity, for 1929–31, in subgroups of the distributive, service, utility and finance divisions, as well as mining, together with other data bearing on the profitability of investments in these industries.

Comparison of the figures with other data covering these fields of enterprise, and with earnings in other industries, remains to be done. It is hoped, especially, that data recently made available in the Census of Service Industries and the Census of Distribution, together with the 1933 corporate data when these are published (by subgroups, if possible) may help in the answering of many questions bearing on the importance, behavior, and structure of the service and distributive industries.

## APPENDIX

*Statistical Section—Income Tax Unit*

Corporation income tax returns for 1930–1932 filed by concerns whose predominant business is classified under certain subdivisions of the following major industrial groups: Mining and quarrying; Transportation and other public utilities; Trade; Service; and Finance; showing the surplus and undivided profits less deficit

(Composite for returns showing net income and no net income)
(In thousands of dollars)

| | Surplus and undivided profits less deficit | | |
|---|---|---|---|
| | 1930 | 1931 | 1932 |
| *Mining and quarrying:* | | | |
| Metal mining—iron, copper, lead, zinc, gold, silver, quicksilver | 987,640 | 906,930 | 787,077 |
| Coal: | | | |
| Anthracite | 221,672 | 255,414 | 229,751 |
| Bituminous, lignite, and peat | 315,681 | 287,592 | 203,401 |
| Oil and gas | 239,946 | 76,575 | 97,015 |
| *Transportation and other public utilities:* | | | |
| Transportation and related activities: | | | |
| Water transportation and related activities—Ocean and fresh-water lines, canals, docking, drawbridge operating, lighterage, salvaging, piloting, wharfing, lessors | 170,346 | 122,721 | 119,629 |
| Aerial transportation | 11,312 | 16,682 | 20,014 |
| Autobus lines, taxicabs, and sightseeing companies | 24,939 | 6,773 | 3,775 |
| Steam railroads | 5,150,492 | 4,404,654 | 3,678,974 |
| Electric railways | 505,623 | 491,311 | 385,282 |
| Electric light and power companies | 4,017,130 | 2,843,858 | 1,583,770 |
| Gas companies, artificial and natural | 608,213 | 565,811 | 484,700 |
| Cartage and storage; food storage; packing and shipping; local transportation and related industries, n. e. c. | 179,135 | 180,540 | 168,085 |
| Other public utilities: | | | |
| Telephone and telegraph companies | 857,876 | 1,104,504 | 1,000,706 |
| Radio broadcasting companies | 34,006 | 22,436 | 21,365 |
| Water companies | 128,962 | 109,667 | 141,559 |
| All other public utilities—Terminal stations, pipe lines, toll bridges and toll roads, irrigation systems, etc. | 742,814 | 463,191 | 427,691 |

| | Surplus and undivided profits less deficit | | |
|---|---|---|---|
| | 1930 | 1931 | 1932 |
| *Trade:* | | | |
| Wholesale | 895,545 | 724,358 | 471,967 |
| Retail | 1,989,569 | 1,690,127 | 1,096,419 |
| Wholesale and retail | 493,169 | 354,718 | 239,545 |
| Commission | 149,049 | 96,005 | 85,649 |
| All other | 91,797 | 59,812 | 42,702 |
| *Service:* | | | |
| Domestic service—laundries, hotels, restaurants, etc. | 261,356 | 136,187 | 53,387 |
| Total amusements | 195,900 | 192,469 | 141,139 |
| Professional service—curative, educational, engineering, legal, etc. | 74,708 | 17,477 | 39,712 |
| Business service—detective bureaus, trade shows, mimeographing, publishing directories, advertising, etc. | 1,121,451 | 624,268 | 420,034 |
| *Finance:* | | | |
| Banking and related industries: | | | |
| Stock and bond brokers, investment brokers, investment bankers, and investment trusts | 1,344,907 | 863,656 | 995,234 |
| Real estate and realty holding companies—realty development, holding, or leasing; realty trust, etc. | 2,007,089 | 1,730,163 | 1,279,612 |
| Insurance companies: | | | |
| Life insurance—mutual or stock companies | 774,085 | 757,443 | 792,851 |
| Other insurance—accident, casualty, fire, marine, title, etc. | 1,383,721 | 904,660 | 831,337 |
| Other finance: | | | |
| Loan companies—building and loan associations; mortgage, note, or pawn brokers; insurance agents, promoters, stock syndicates, foreign exchange, and finance, n. e. c. | 5,781,110 | 3,483,926 | 3,104,900 |

# ON THE INFLUENCE OF CLASSIFICATION ON THE DETERMINATION OF A MEASURABLE CHARACTERISTIC

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## 1. INTRODUCTION

Invariably in the measurement of each of a number of individuals for a certain quantitative characteristic there is a certain least count, below which—be it large or small—further classification is not made. The lower limit of the least count is fixed in the manufacture of the measuring instrument, but in practice a spacing much wider than that is often voluntarily adopted for convenience, and with little loss in accuracy provided the spacing be not too wide. To investigate the loss of accuracy resulting thus is in fact the main purpose of this paper.

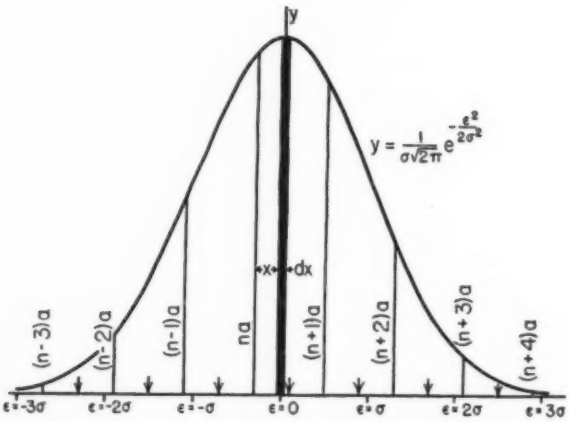
The immediate result of classification is that the observations are grouped; each observation is, in effect, transferred to and recorded at the center of the class in which it appears to fall. The most familiar consequence of classification is the average shift in the moments of a frequency distribution, as is adequately described—at least under the circumstances originally stipulated by their originator—by Sheppard's corrections, whose nature has been considerably elucidated by Fisher [1] and Wilson.[2] Sheppard's corrections involve only even powers of the class interval and for this reason can be called "second order", but not with the implication that their magnitude is necessarily unimportant.

Besides the effect on moments, there are two other consequences of grouping that need to be considered. Of these, the first here to be discussed is an apparent increase in the experimentally obtained standard error of single measurements—an effect recognized by Meyer [3] in 1934 but not until now evaluated. The second effect was recognized and evaluated by Tischendorf [4] in 1925. As will become clear later, the two are closely related and are in fact supplementary. Like Sheppard's corrections, they too are "second order".

[1] R. A. Fisher, *Phil. Trans. Roy. Soc.* A222, 309–368 (1921–22). See especially pages 317–320.
[2] E. B. Wilson, *Proc. Nat. Acad. Sci.* 13, 151–156 (1927).
[3] H. Arthur Meyer, Beiheft Nr. 13 zu den *ZS. des Schweizerischen Forstvereins* (Zürich, 1934).
[4] W. Tischendorf, several articles in the *Forstwissenschaftliches Centralblatt* (Berlin) for the year 1925. See also his *Lehrbuch der Holzmassenermittlung* (Berlin, 1927) pp. 57–58.

## 2. THE RECORDING ERROR

Suppose that the true value of a measured quantity lies between $na + x$ and $na + x + dx$, as shown by the shaded strip in the figure. On the assumption of the normal law of error, observations on this true value will be distributed on a normal curve of S. D. $\sigma$, centered at $na + x$, the true value.




The normal curve of error, centered at the value being measured. a is the least count, and the arrows point to the discrete values that will be recorded

Now any continuous curve of error implies that the least count is infinitesimal. In any actual measurement, however, this is not the case; the least count, instead of being infinitesimal, is some finite amount $a$; and the result is that observations are necessarily recorded at discrete points midway between certain class limits. With the choice of scale shown in the figure, these midpoints are located at $\ldots, -\frac{3}{2}a, -\frac{1}{2}a, \frac{1}{2}a, \frac{3}{2}a, \frac{5}{2}a, \ldots, (n+\frac{1}{2})a, (n+\frac{3}{2})a, \ldots$, as shown by the arrows. An observation which is recorded at $(n + \frac{1}{2})a$ must have fallen in the same class with the true value: for this reason we say that it has a "recording error" of 0. An observation recorded at $(n + \frac{3}{2})a$ has a recording error of $a$; one recorded at $(n + \frac{5}{2})a$ has a recording error of $2a$; etc. Observations recorded at $(n - \frac{1}{2})a$, $(n - \frac{3}{2})a$, ... have recording errors $-a, -2a, \ldots$.

It will be understood that what we are here calling "recording error" arises from two sources: first, from the accidental errors of measurement, which with infinitesimal classes are, by assumption, described by the normal curve of S.D. $\sigma$; and second, from an aberration caused

by grouping, or the transfer of each observation to the center of the class in which it falls.

Areas under the normal curve centered at the true value $na + x$ give the relative frequencies of the recording errors. To consider all possible values of $x$ as "equally likely" within the class $na < x < (n+1)a$, and to weight the squares of the recording errors proportional to their relative frequencies (areas under the normal curve), we should set up the following series of integrals for the apparent mean square recording error of single observations (abbreviated M.S.R.E.):

$$\text{M.S.R.E.} = \frac{1}{a}\int_0^a dx \frac{1}{\sigma\sqrt{2\pi}}\Bigg[ \ldots + (-2a)^2 \int_{\epsilon=-2a-x}^{-a-x} e^{-\epsilon^2/2\sigma^2} d\epsilon$$

$$+ (-a)^2 \int_{\epsilon=-a-x}^{-x} e^{-\epsilon^2/2\sigma^2} d\epsilon + 0 \int_{\epsilon=-x}^{a-x} e^{-\epsilon^2/2\sigma^2} d\epsilon$$

$$+ a^2 \int_{\epsilon=a-x}^{2a-x} e^{-\epsilon^2/2\sigma^2} d\epsilon + (2a)^2 \int_{\epsilon=2a-x}^{3a-x} e^{-\epsilon^2/2\sigma^2} d\epsilon + \ldots \Bigg] \quad (1)$$

Each of these integrals can be evaluated closely enough by the use of Sheppard's "spurious curve of frequency".[5] By this device the area of a strip of width $a$ under the normal curve of S.D. $\sigma$ is placed equal to the product of the width $a$ by the ordinate of a "spurious" normal curve at the the midpoint of the strip, the "spurious" curve to be centered with the old one but to have the "spurious" S.D. $\sigma'$, where $\sigma'^2 = \sigma^2 + a^2/12$. This is not an exact result, but is an approximation of great utility.[6] Applied to the above integrals it gives

$$\text{M.S.R.E.} = \frac{1}{a}\int_0^a dx \frac{a}{\sigma\sqrt{2\pi}} \Sigma(sa)^2 \int_{\epsilon=sa-x}^{(s+1)a-x} e^{-\epsilon^2/2\sigma^2} d\epsilon$$

$$= \frac{1}{a}\int_0^a dx \frac{1}{\sigma'\sqrt{2\pi}} \Sigma(sa)^2 \, e^{-[(s+\frac{1}{2})a-x]^2/2\sigma'^2} \quad (2)$$

where $$\sigma'^2 = \sigma^2 + a^2/12. \quad (3)$$

[5] W. F. Sheppard, *Proc. London Math. Soc.* 29, 353–380 (1897).
[6] Karl Pearson, *Biometrika* 3, 308–312 (1904).

The sign of summation, $\Sigma$, implies that the index $s$ is to run over all integers, positive and negative, zero included. Practically, it need cover only the range from $-3\sigma$ to $+3\sigma$.

Once again applying this device of Sheppard's to a rearrangement of Eq. (2) we find that the

$$\text{M.S.R.E.} = \frac{1}{\sigma'\sqrt{2\pi}} \Sigma(sa)^2 \int_{x=0}^{a} e^{-[(s+\frac{1}{2})a-x]^2/2\sigma'^2} dx$$

$$= \frac{a}{\sigma''\sqrt{2\pi}} \Sigma(sa)^2 \, e^{-s^2a^2/2\sigma''^2} \tag{4}$$

$$= \frac{2a^3}{\sigma''\sqrt{2\pi}} \sum_{s=0}^{\infty} s^2 e^{-s^2a^2/2\sigma''^2} \tag{5}$$

where $$\sigma''^2 = \sigma'^2 + a^2/12 = \sigma^2 + a^2/6. \tag{6}$$

Now by the Euler-Maclaurin summation formula, the summation in Eq. (5) can be replaced by an integral to the same degree of approximation as that introduced by Sheppard's "spurious" curve; hence

$$\text{M.S.R.E.} = \frac{2a^3}{\sigma''\sqrt{2\pi}} \int_0^{\infty} s^2 \, e^{-s^2a^2/2\sigma''^2} ds = \frac{2a^3}{\sigma''\sqrt{2\pi}} \frac{\sqrt{2}\,\sigma''^3}{a^3} \Gamma(\tfrac{3}{2})$$

$$= \sigma''^2 = \sigma^2 + a^2/6 \tag{7}$$

since $\Gamma(\frac{3}{2}) = \frac{1}{2}\,\Gamma(\frac{1}{2}) = \frac{1}{2}\sqrt{\pi}$.

Thus the M.S.R.E. with classes of width $a$ is greater by $a^2/6$ than if the classes were infinitesimal. It is to be remembered that this result was derived by an approximation, and it should not be expected to hold when $a$ is very large compared with $\sigma$. By actual computation, however, we have found that when $a$ is as large as $3\sigma$, formula (7) is only 3 per cent high, and when $a = 4\sigma$ it is less than 7 per cent high. Clearly, however, it breaks down eventually, for if $\sigma$ were made very small while $a$ remains moderate in size, so that $a/\sigma$ is very large, the M.S.R.E. would be zero. In such a situation there remains only the "error of position", next to be considered.

### 3. THE ERROR OF POSITION

In the preceding section no account was taken of the distance between the true value and the center of the class in which it lies. In the figure this distance is $\frac{1}{2}a - x$. Now again for "equally likely" values of $x$ within the class, the mean square value of $\frac{1}{2}a - x$ is

$$\text{M.S.E.P.} = \frac{1}{a}\int_{-\frac{1}{2}a}^{\frac{1}{2}a} (\tfrac{1}{2}a - x)^2 \, d(\tfrac{1}{2}a - x) = \frac{1}{a}\int_{-\frac{1}{2}a}^{\frac{1}{2}a} u^2 \, du = a^2/12. \tag{8}$$

This we call the mean square "error of position" (M.S.E.P.). As stated in the introduction, it was first recognized and evaluated by Tischendorf [4] in 1925, who called it "mittlerer Abrundungsfehler". Tirén [7] in 1929 explained it as a "Repräsentationsfehler", which may perhaps best be translated as "error of position". His considerations, to pass to an example in forestry, are roughly as follows.

According to the accidental position of the class limits there arises in the recording of the diameter of a tree an accidental error of rounding off (classification), which in the maximum has a magnitude $\frac{1}{2}a$. On the other hand, if we consider the size and position of the classes as given, then the accidental error of rounding off arises because the difference between the true diameter and the center of the class in which it lies is to be considered accidental. Hence any one tree of the forest is subject to a mean square "error of position" (Repräsentationsfehler) of amount $a^2/12$, as found in Eq. (8).

This M.S.E.P., $a^2/12$, exists regardless of how large or how small $\sigma$ may be, and in any case is to be added to the M.S.R.E. to obtain the total apparent mean square error (A.M.S.E.) of single measurements. When, therefore, $a/\sigma$ is not so large as to invalidate formula (7), the

$$\text{A.M.S.E.} = \sigma^2 + a^2/6 + a^2/12 = \sigma^2 + a^2/4. \qquad (9)$$

If $\sigma$ were vanishingly small compared with $a$, the M.S.R.E. would be zero, as explained at the end of the last section, but the M.S.E.P. would retain its value, $a^2/12$.

## 4. DISCUSSION AND APPLICATION

A frequent problem in forestry is to determine the volume of wood contained in a forest stand, and by repeated inventories the current or periodic growth. This is done by measuring and remeasuring after 5 or 10 years the breast height diameter of all the trees standing on the area considered. In order to obtain reliable averages—especially with regard to the current growth—it is necessary to measure a great number of trees, often from some hundred to many thousand. A fast working method of measuring must therefore be used. Usually every tree is measured only once. Because the cross section of a tree is not perfectly round, different results are obtained if the diameter is taken at slightly different places. The resulting error of measurement may be determined experimentally by repeated measurements of one or several trees. These errors being relatively high (*i.e.*, $\sigma$ being relatively large compared with $a$), it is clear that little would be gained if every

[7] L. Tirén, *Reports of the Swedish Institute of Experimental Forestry* (Stockholm) 25, 229–304 (1929).

tree were measured to a tenth or even a whole millimeter. Because it is also more convenient to use relatively big diameter classes and to determine merely in which diameter classes the trees of a stand belong, this procedure has become a common and justifiable practice in forestry.

Let us suppose that we are to measure trees whose diameters range more or less uniformly between 30 and 40 cm. Experience in forestry has shown that with the care usually exercised in measuring large areas covered with trees of this diameter range, the mean error of single measurements of a diameter, using a very small least count, may be about 1.6 cm. With this value of $\sigma$, it follows from Eq. (9) that the *apparent* mean square error (A.M.S.E.) of single measurements, when a class interval of $a$ cm. is employed, is

$$\text{A.M.S.E.} = \sigma^2 + a^2/6 + a^2/12 = 1.6^2 + a^2/4 \quad (\text{cm.}^2) \qquad (10)$$

from which it is found that

| | | | | |
|---|---|---|---|---|
| if $a = 0$, | the | A.M.S.E. | is | 1.6 cm. $(= \sigma)$ |
| $a = 1$ cm., | " | " | " | 1.7 " |
| $a = 2$ cm., | " | " | " | 1.9 " |
| $a = 3$ cm., | " | " | " | 2.2 " |
| $a = 4$ cm., | " | " | " | 2.6 " |

In practice, there is always to be feared not only the presence of accidental errors of measurement and of classification, but also the presence of constant and other errors, independent of the class interval, caused for instance by the use of inaccurate instruments (calipers), or by sampling errors, such as the inadvertent omission of certain trees that should have been measured; hence we may conclude that unless extreme refinement is desired it would seem permissible in the above case to take advantage of the convenience of a spacing as wide as 2 or 3 cm., or even, for some types of work, a spacing as wide as 4 cm.

The "error of position" may be illustrated by another example from forestry. Suppose that the diameters of the trees on a certain area are remeasured after a lapse of a few years in order to determine the growth that has taken place over that period. Let us assume that there are no accidental errors of measurement (i.e., $\sigma = 0$), but that we would nevertheless apply wide diameter classes. Now if every tree would grow exactly the same amount, and exactly some multiple of the class interval being used, then the "error of position", which has for each tree a definite value—the same in both inventories—would be completely eliminated from the growth, which comes by taking the

difference of the two sets of diameters. But of course such a situation never really exists; the "error of position" for each tree is different at the two inventories, and there is no telling what it may amount to at either time. So if the average growth per tree of a stand is computed by subtracting the average diameter at the earlier inventory from the average diameter at the latter, there will be feared a M.S.E.P. amounting to twice $a^2/12$, or $a^2/6$. This is in addition to the M.S.R.E., which will be twice $\sigma^2 + a^2/6$, or $2\sigma^2 + a^2/3$. Altogether, there is to be feared an A.M.S.E. of $2\sigma^2 + \frac{1}{2}a^2$ in computing the average growth per tree of a stand.

# TRENDS IN THE AGES OF GAINFUL WORKERS, BY OCCUPATION, 1910–1930

By Mapheus Smith, *University of Kansas*

During the last decade much has been said and written about the increase in the age of the nation's population. A number of changes in the age of the population are particularly significant:

I. Changes in the Age of the General Population
   1. The Increasing Average Age of the General Population
      This is accompanied by a decline in the percentage of children and of adults up to about 35 years of age and an increase in the percentage of those of each sex over 40 years of age.
   2. Employment Status of the General Population
      a. The percentage of the total population 45 years of age and over which is gainfully employed increased gradually from 44 per cent in 1870 to 53 per cent in 1910, and declined to 52 per cent in 1930.
      b. The percentage of the total population in the most employable ages (16–64 years) which is gainfully employed reached a peak of approximately 62 per cent in 1910, declined to 59.6 per cent in 1920 and declined slightly to 59.1 per cent in 1930. In 1930 a greater percentage of the population between 20 and 44 years of age was employed than in 1920, but the percentage was smaller for the older and younger groups. In spite of a percentage decline from 1910, the actual number of gainful workers has steadily increased.

II. Changes in the Ages of the Gainfully Occupied Population
   1. Changes in Percentage of Gainful Workers in Different Age Groups
      a. There has been a steady decrease in the percentage of male gainful workers under 35 years of age since 1910, and an increase in all other age groups. The decreases and increases were fairly uniform throughout.
      b. There has been a decrease in the percentage of female gainful workers under 35 years of age, and an increase in those who are older. Changes were not regular, the biggest increases and decreases occurring from 1920 to 1930. The

increases have been greatest from ages 40 to 50, and very slight at age 60.

2. Changes in the Median Age of Gainful Workers
   a. The median age of the gainfully occupied population (16–64) has increased from 32 years in 1890 to 35 years in 1930, compared with an increase from 30.7 to 35.7 years for the gainfully occupied population 10 years of age and over. Since 1910 the rate of change of the two groups has been almost exactly the same. The age of the gainfully occupied is not increasing quite so rapidly as that of the total population.
   b. The median age of male gainful workers 16 to 64 increased from 33.2 years in 1890 to 36.5 years in 1930; that of females increased from 25.0 to 30.0 years during the same period. The age of males increased much more slowly than that of females to 1910 and since then it has increased more rapidly.

Here, however, available data on age trends of gainful workers are about exhausted. A decrease in younger workers, and a corresponding increase of older workers has brought about an increase of 5.9 years in the median age of the gainfully employed male population and an increase of 1.2 years in the age of female workers from 1910 to 1930. But there is almost nothing available in a published form on age changes in socio-economic classes and specific occupations. Hitherto, it has not been possible to say which occupations are typical of the age trends of the total gainfully employed population, and which are aging more or less rapidly than the average. The decennial censuses have included data on occupations by age and sex but the occupational classifications were so different that it is difficult to compare the occupational data during this period. Now, however, reliable information on the median ages of workers in 53 selected occupations over a period of three decades is available for the first time, much of the basic data drawn directly from published census statistics properly classified and the remainder obtained from them by simple estimation procedures.

The sequence of steps traversed in obtaining comparable figures upon which the median ages presented in Table I are based, briefly stated, was as follows:

1. As a matter of convenience, occupations closely affiliated were grouped so as to obtain occupational classes embracing all of the

occupations included in the 1930 census classification. For example: actors and showmen were grouped together, as were

TABLE I

MEDIAN AGES OF WORKERS 16 TO 64 YEARS OF AGE IN SELECTED OCCUPATIONAL GROUPS, 1910, 1920, AND 1930[1]

| Occupation | Male | | | Female | | |
|---|---|---|---|---|---|---|
| | 1910 | 1920 | 1930 | 1910 | 1920 | 1930 |
| All gainful workers | 33.9 | 35.4 | 36.5 | 27.8 | 28.5 | 30.0 |
| Total of 53 occupations | 31.3 | 33.6 | 34.6 | 28.5 | 28.7 | 29.8 |
| *Professional persons* | | | | | | |
| Musicians and teachers of music | 32.6 | 34.8 | 33.0 | 29.2 | 31.8 | 35.4 |
| Teachers (schools and colleges) | 31.8 | 34.2 | 33.5 | 28.4 | 27.6 | 29.7 |
| *Proprietors, managers and officials* | | | | | | |
| Wholesale and retail dealers | 40.3 | 41.2 | 41.6 | 40.9 | 41.6 | 42.6 |
| *Clerical workers* | | | | | | |
| Bookkeepers, cashiers and accountants | 30.5 | 31.3 | 32.4 | 25.5 | 23.8 | 27.1 |
| Clerical workers (proper) | 24.0 | 29.1 | 30.1 | 24.0 | 23.9 | 26.3 |
| Office boys, telegraph and other messengers | 20.9 | 21.3 | 21.2 | 20.9 | 21.4 | 21.5 |
| Stenographers and typists | 23.6 | 23.6 | 24.3 | 23.0 | 22.8 | 23.7 |
| Telephone operators | 24.7 | 29.4 | 32.6 | 22.1 | 22.4 | 23.8 |
| *Sales people* | | | | | | |
| Commercial travelers | 37.0 | 38.0 | 38.8 | 36.9 | 38.1 | 39.8 |
| Newsboys | 22.6 | 23.7 | 22.5 | 27.3 | 30.4 | 25.9 |
| Real estate and insurance agents | 41.9 | 42.4 | 41.7 | 40.4 | 42.3 | 44.1 |
| Salesmen and saleswomen (proper) | 30.2 | 31.6 | 32.7 | 24.7 | 26.3 | 29.5 |
| *Skilled workers and foremen* | | | | | | |
| Blacksmiths, forgemen and hammermen | 38.4 | 39.5 | 43.6 | — | — | — |
| Boilermakers | 34.0 | 35.1 | 39.8 | — | — | — |
| Brick and stone masons and tile layers | 38.3 | 41.5 | 39.9 | — | — | — |
| Cabinet makers | 39.4 | 41.0 | 41.3 | — | — | — |
| Carpenters | 39.4 | 41.5 | 43.4 | — | — | — |
| Electricians | 29.3 | 30.0 | 33.1 | — | — | — |
| Locomotive engineers and firemen | 34.7 | 35.6 | 41.6 | — | — | — |
| Machinists, millwrights and tool makers | 32.4 | 33.1 | 37.0 | — | — | — |
| Molders, founders, casters (metal) | 35.2 | 37.1 | 39.9 | — | — | — |
| Painters, enamelers and varnishers (building) and paperhangers | 36.0 | 40.6 | 39.7 | — | — | — |
| Plasterers and cement finishers | 37.9 | 40.5 | 38.6 | — | — | — |
| Plumbers, gas and steam fitters | 32.0 | 34.8 | 37.2 | — | — | — |
| Sawyers | 34.7 | 37.7 | 38.1 | — | — | — |
| Structural iron workers (building) | 33.8 | 35.2 | 37.0 | — | — | — |
| Tailors and tailoresses | 35.2 | 39.0 | 43.1 | 27.7 | 32.5 | 37.1 |
| Tin and coppersmiths | 33.8 | 33.9 | 37.5 | — | — | — |
| Skilled workers, printing, publishing and engraving | 30.8 | 34.5 | 33.9 | 23.9 | 27.3 | 30.9 |
| *Semi-skilled workers* | | | | | | |
| Painters, glaziers, enamelers, and varnishers in factories | 33.8 | 35.3 | 34.8 | 22.6 | 24.4 | 23.6 |
| Bakers | 32.3 | 35.0 | 34.3 | 36.4 | 37.0 | 38.9 |
| Dressmakers, seamstresses and milliners | 34.9 | 38.2 | 39.1 | 33.3 | 38.8 | 42.8 |
| Grinders, filers, buffers and polishers (metal) | 31.2 | 34.9 | 36.5 | 23.4 | 24.8 | 25.8 |
| Operatives in cigar factories | 33.0 | 38.1 | 40.0 | 23.9 | 26.1 | 27.2 |
| Operatives in clothing factories | 31.1 | 34.4 | 36.8 | 24.1 | 26.9 | 29.3 |
| Barbers, hairdressers and manicurists | 34.0 | 37.2 | 38.2 | 30.0 | 32.6 | 30.7 |
| Boarding and lodging house keepers | 44.7 | 47.3 | 49.1 | 43.2 | 46.1 | 46.8 |
| Brakemen | 30.9 | 32.7 | 37.3 | — | — | — |
| Housekeepers, stewards and practical nurses | 36.5 | 38.8 | 39.7 | 38.6 | 41.7 | 44.6 |
| Watchmen, guards and doorkeepers | 47.4 | 51.6 | 51.0 | 35.8 | 41.7 | 46.0 |
| *Unskilled workers* | | | | | | |
| Farm laborers | 24.1 | 24.7 | 24.5 | 26.4 | 27.0 | 25.6 |
| Charwomen, cleaners, and laundresses | 36.8 | 38.6 | 37.6 | 36.4 | 38.8 | 40.6 |
| Elevator tenders | 28.0 | 30.5 | 33.2 | — | — | — |
| Porters | 31.9 | 35.6 | 34.8 | — | — | — |
| Servants | 32.9 | 35.4 | 34.7 | 27.5 | 31.4 | 31.7 |
| Waiters, waitresses and bartenders | 32.4 | 33.4 | 32.7 | 24.5 | 26.5 | 25.9 |
| *Other laborers* | | | | | | |
| Draymen, teamsters and expressmen | 31.9 | 33.5 | 39.8 | — | — | — |
| Firemen (except locomotive and fire department) | 34.0 | 37.0 | 40.3 | — | — | — |
| Fishermen and oystermen | 35.5 | 38.1 | 38.1 | 34.9 | 33.4 | 38.3 |
| Furnacemen, smelter men, heaters, and puddlers | 33.7 | 34.6 | 37.9 | — | — | — |
| Longshoremen and stevedores | 35.3 | 36.5 | 39.6 | — | — | — |
| Lumbermen, raftsmen and woodchoppers | 32.8 | 33.9 | 35.8 | — | — | — |
| Miners, oil, gas and salt well operatives | 32.4 | 33.8 | 35.8 | 24.6 | 27.0 | 24.3 |

[1] In calculating the median age, it has been assumed that the ages of workers form a discrete series the basic unit of which is one-tenth year. Where no median age is given there were too few cases for measures of central tendency to be reliable.

artists, sculptors and teachers of art; wholesale and retail dealers; bookkeepers, cashiers and accountants; and real estate and insurance agents. The purpose of these and the other groupings is to reduce the number of classes without increasing the heterogeneity of the combination so much that it is meaningless. The inclusiveness of the various occupations can be seen from their names in the table.

2. Certain of the occupations were selected for study on the basis of their homogeneity, and so as to include a preponderance of skilled, semi-skilled and unskilled groups but only one or two examples from the professions and proprietorial classes, which are probably the most homogeneous of the Edwards socio-economic classification.[1]

3. Occupational statistics from the 1910, 1920 and 1930 censuses were classified into the occupations that are included in this report. The comparisons of the occupational classification of the 1910, 1920 and 1930 censuses with the classification employed here had to be made separately. The 1910 and 1920 data were classified with the aid of occupational indexes, and numerous items which appeared on the surface to be equivalent to items in the 1930 classification proved to be incomparable and could not be used. Data from some of the items were adjusted by estimation by the inclusion or exclusion of a relatively small proportion of persons.

   It had been hoped that the data for 1900 might be used, giving a longer trend, but inspection of the difference between the classifications of the 1900 census and the other censuses showed this to be impossible. Changes in the census classification, and equally as important changes in the industrial and occupational organization of the country make the occupational data before 1910 almost entirely incomparable with that appearing subsequently.

4. The data were summarized in five age groups: 16–24; 25–34; 35–44; 45–54; and 55–64. Data from each of the three censuses had to be adjusted in one or more particulars in order to obtain age groups which were comparable. The most detailed age breakdown obtainable for 1910 gainful workers by sex and occupation, even by use of an unpublished census table, was 10 to 13, 14 and 15, 16 to 20, 21 to 44, and 45 and over. The 1920 age breakdown, more nearly comparable to the 1930 data, was 10

[1] Edwards, Alba M., "A Social-Economic Grouping of the Gainful Workers of the United States," JOURNAL OF THE AMERICAN STATISTICAL ASSOCIATION, December, 1933, pp. 377–387.

to 13, 14, 15, 16, 17, 18 and 19, 20 to 24, 25 to 44, and 45 to 64;[2] and that of the 1930 Census was 10 to 17, 18 and 19, 20 to 24, and five year intervals up through 64 years.[3]

The 1910 and 1920 data were distributed in accordance with the selected age breakdown by means of graphic interpolation on cumulative percentage curves, all drawn by freehand methods by the same person. The 1930 curve was first drawn for a given occupation through a very complete assortment of points from a zero percentage at age 10 to a percentage of 99.5 at age 80. Then the 1920 and 1910 curves were drawn on the same sheet through the same initial and final points and the points at the ages mentioned above. The curves thus constructed were made to conform to the same general character of the 1930 curve and were smoothed. From the 1920 and 1910 curves the percentages for each unknown limit of the selected age groups were read and applied to the total gainful workers obtained from the census volumes.[4]

The assumption that the 1910 and 1920 curves follow the general configuration of the 1930 curves for each occupation does not appear to be unreasonable; in fact, it is about as reasonable to suppose that the slope of one curve between the known points has the same character as that of another curve based upon similar data, as to say that the data for every occupation produce a smooth curve. The latter assumption is never seriously questioned, and, as a consequence, the first need not be.

The distributions thus provided from each of the three censuses were exactly comparable in occupational and age breakdown, and were ready to be used in the calculation of median ages.

*Occupations Decreasing in Age.* Practically all of the 53 occupational groups increased in median age between 1910 and 1930. The only exceptions among males were newsboys, and real estate and insurance agents; and among females were newsgirls, farm laborers, and operatives in mineral extractive industries. Each of these occupa-

[2] The 1920 data were from Vol. IV, Chapter IV, Table 6, pp. 378 ff. of the Fourteenth Census.

[3] The 1930 data were from Vol. V, Chapter IV, Table 6, pp. 118 ff of the Fifteenth Census.

[4] The 1920 data admittedly are somewhat incorrect, because of the effect of the war upon industrial organization and on the number of workers in various occupations between 20 and 31 years of age. Data on the occupations of drafted men, however, make it clear that the net effect of the war on the percentage distribution of workers in an occupation is not greater than one or two tenths of one per cent. Soldiers were drawn from the occupations with the largest number of workers and many of these had returned to employment before the 1920 Census was taken. Another error of the 1920 Census data grows out of the difference in the time of taking the Census: June 1st for 1910; April 1st for 1930; and January 1st for 1920. This had little or no effect on the ages of workers.

TABLE II

PERCENTAGE DISTRIBUTION BY AGE GROUPS OF GAINFUL WORKERS 16 TO 64 YEARS OF AGE IN CERTAIN GROUPINGS OF SELECTED OCCUPATIONS,* 1910, 1920 AND 1930

| | Census year | Males | | | | | | Females | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Total | 16–24 | 25–34 | 35–44 | 45–54 | 55–64 | Total | 16–24 | 25–34 | 35–44 | 45–54 | 55–64 |
| Total for 53 occupations | 1910 | 100.0 | 32.5 | 27.4 | 20.9 | 12.7 | 6.5 | 100.0 | 40.2 | 27.3 | 17.6 | 10.0 | 4.9 |
| | 1920 | 100.0 | 26.7 | 26.9 | 22.4 | 15.3 | 8.7 | 100.0 | 40.2 | 26.1 | 17.3 | 10.6 | 5.8 |
| | 1930 | 100.0 | 25.3 | 25.6 | 22.8 | 16.7 | 9.6 | 100.0 | 36.9 | 26.6 | 18.3 | 12.1 | 6.1 |
| Proprietors, managers and officials (wholesale & retail dealers, only) | 1910 | 100.0 | 7.2 | 25.7 | 32.0 | 22.4 | 12.7 | 100.0 | 8.6 | 23.0 | 31.1 | 23.3 | 14.0 |
| | 1920 | 100.0 | 6.6 | 24.6 | 30.2 | 23.5 | 15.1 | 100.0 | 7.7 | 21.4 | 31.6 | 23.2 | 16.1 |
| | 1930 | 100.0 | 6.4 | 22.9 | 30.6 | 25.0 | 15.1 | 100.0 | 5.9 | 19.8 | 32.1 | 27.3 | 14.9 |
| Clerical workers | 1910 | 100.0 | 50.7 | 23.9 | 13.5 | 7.8 | 4.1 | 100.0 | 59.7 | 27.4 | 10.2 | 1.8 | 0.9 |
| | 1920 | 100.0 | 38.8 | 28.3 | 17.7 | 10.0 | 5.2 | 100.0 | 60.5 | 26.4 | 9.4 | 2.8 | 0.9 |
| | 1930 | 100.0 | 34.9 | 30.0 | 18.2 | 10.9 | 6.0 | 100.0 | 51.2 | 30.3 | 12.3 | 4.8 | 1.4 |
| Sales people | 1910 | 100.0 | 27.2 | 30.1 | 21.8 | 13.9 | 7.0 | 100.0 | 50.9 | 27.4 | 14.7 | 5.2 | 1.8 |
| | 1920 | 100.0 | 23.6 | 29.5 | 22.6 | 15.5 | 8.8 | 100.0 | 45.3 | 27.3 | 16.5 | 7.5 | 3.4 |
| | 1930 | 100.0 | 21.0 | 30.0 | 24.4 | 15.9 | 8.7 | 100.0 | 36.7 | 24.8 | 20.9 | 12.8 | 4.8 |
| Skilled workers and foremen | 1910 | 100.0 | 19.2 | 29.7 | 26.1 | 16.6 | 8.4 | 100.0 | 46.1 | 26.1 | 15.6 | 8.3 | 3.9 |
| | 1920 | 100.0 | 15.8 | 29.3 | 26.7 | 18.5 | 9.7 | 100.0 | 32.4 | 28.6 | 20.0 | 12.2 | 6.8 |
| | 1930 | 100.0 | 13.2 | 25.3 | 28.0 | 21.4 | 12.1 | 100.0 | 25.0 | 24.5 | 24.9 | 17.0 | 8.6 |
| Semi-skilled workers | 1910 | 100.0 | 22.9 | 31.2 | 24.7 | 14.6 | 6.6 | 100.0 | 29.9 | 25.5 | 21.8 | 14.8 | 8.0 |
| | 1920 | 100.0 | 15.9 | 28.6 | 26.4 | 17.9 | 11.2 | 100.0 | 23.1 | 23.3 | 22.4 | 18.5 | 12.7 |
| | 1930 | 100.0 | 15.4 | 25.1 | 26.8 | 19.9 | 12.8 | 100.0 | 22.9 | 21.1 | 22.4 | 19.9 | 13.7 |
| Farm laborers | 1910 | 100.0 | 55.7 | 21.6 | 11.6 | 6.7 | 4.4 | 100.0 | 46.6 | 25.3 | 15.2 | 8.6 | 4.3 |
| | 1920 | 100.0 | 51.8 | 20.5 | 12.6 | 9.0 | 6.1 | 100.0 | 45.4 | 23.2 | 17.4 | 9.7 | 4.3 |
| | 1930 | 100.0 | 52.9 | 20.1 | 11.4 | 9.2 | 6.4 | 100.0 | 48.8 | 20.9 | 15.6 | 10.4 | 4.3 |
| Servant classes | 1910 | 100.0 | 25.7 | 32.4 | 24.5 | 12.1 | 5.3 | 100.0 | 36.6 | 27.3 | 18.6 | 11.7 | 5.8 |
| | 1920 | 100.0 | 20.8 | 29.4 | 25.1 | 16.2 | 8.5 | 100.0 | 29.4 | 26.2 | 21.4 | 14.9 | 8.1 |
| | 1930 | 100.0 | 23.6 | 28.6 | 24.4 | 15.7 | 7.7 | 100.0 | 31.1 | 24.9 | 21.1 | 15.2 | 7.7 |
| Other laborers | 1910 | 100.0 | 25.2 | 32.5 | 24.0 | 13.3 | 5.0 | 100.0 | 44.4 | 22.5 | 17.1 | 10.6 | 5.4 |
| | 1920 | 100.0 | 22.9 | 29.4 | 24.4 | 15.3 | 8.0 | 100.0 | 49.6 | 23.2 | 14.0 | 8.4 | 4.8 |
| | 1930 | 100.0 | 19.0 | 26.1 | 26.1 | 19.5 | 9.3 | 100.0 | 46.1 | 21.2 | 17.9 | 10.4 | 4.4 |

* Each grouping contains only the selected occupations listed in Table I and is not intended to represent all occupations which might be included in it.

tions was marked either by an increase in the percentage of workers in the age group 16 to 24 or a decrease in the age group 55 to 64, or both.

*Occupations Above Average in Rate of Increase in Age.* Most of the other male occupational groups aside from newsboys, and real estate and insurance agents increased only slightly in median age, but eight increased more than six years: male clerical workers (proper) (6.1), telephone operators (7.9), locomotive engineers and firemen (6.9), tailors (7.9), operatives in cigar factories (7.0), brakemen (6.4), firemen (except locomotive and fire department firemen) (6.3), and draymen, teamsters and expressmen (7.9). These occupations were uniformly marked by a percentage decrease in workers 16 to 24 years of age and an increase in the percentage of workers above 35 years of age.

Many other male occupations surpassed the average of the 53 in amount of increase in age (3.3 years):

blacksmiths, forgemen and hammermen
boilermakers
carpenters
electricians
machinists, millwrights and toolmakers
molders, founders and casters (metal)
painters, enamelers, varnishers (in buildings) and paperhangers
plumbers and gas and steam fitters
sawyers
structural iron workers in buildings
tinsmiths and coopersmiths
dressmakers, seamstresses and milliners
grinders, filers, buffers and polishers (metal)
operatives in clothing factories
barbers, hairdressers and manicurists
boarding and lodging house keepers
watchmen, guards and doorkeepers
elevator tenders
furnacemen, smelter men, heaters and puddlers
longshoremen and stevedores
operatives in mineral extractive industries

In most of these occupations the percentage of those above 35 years of age increased during the twenty-year period, while the percentage of those under 35 years of age decreased. The percentage of sawyers; structural iron workers in buildings; and boarding and lodging house keepers above 45 increased; while for watchmen, guards and doorkeepers only the proportion above 55 years of age increased.

Because the median age of female gainful workers increased less than that of males (1.3 years for the occupations under discussion

here) almost all female occupations exceeded the average amount of increase for the whole group, and many of them surpassed the median increase in age for all female gainful workers 16 to 64 years of age (2.2 years):

musicians and teachers of music (6.2 years)
teachers in school and college (1.3 years)
wholesale and retail dealers (1.7 years)
bookkeepers, cashiers and accountants (1.6 years)
clerical workers (proper) (2.3 years)
telephone operators (1.7 years)
commercial travelers (2.9 years)
real estate and insurance agents (3.7 years)
boarding and lodging house keepers (3.6 years)
housekeepers, stewardesses, and practical nurses (6.0 years)
watchmen, guards and doorkeepers (10.2 years)
charwomen, cleaners, and laundresses (4.2 years)
saleswomen (proper) (4.8 years)
tailoresses (9.4 years)
skilled workers in printing, publishing and engraving (7.0 years)
bakers (2.5 years)
dressmakers, seamstresses and milliners (9.5 years)
filers, grinders, buffers, and metal polishers (2.4 years)
operatives in cigar factories (3.3 years)
operatives in clothing factories (5.2 years)
servants (4.2 years)
waitresses and barmaids (1.4 years)
fishermen and oystermen (3.4 years)

We do not know the precise causes of the changes in average age reviewed above, but the general pattern of explanation appears to be a combination of average age at time of employment and average duration of employment of the workers concerned. Important evidence can be obtained by comparing the average age of persons placed in different occupations at comparable dates. Such a comparison shows that occupations differ in average age of persons placed, in average age of all workers engaged, and in difference between average age of persons placed and average of all workers engaged; and also that the occupational differences between average age of persons placed and the average age of persons gainfully employed are positively correlated to a medium degree.[5] Such a correlation indicates that

[5] A crude but indicative measure of this fact is a correlation coefficient of $+.54 \pm .10$ (Standard Error) for United States Employment Service placements in October 1934, compared with gainfully occupied workers of both sexes in 1930. The U.S.E.S. data were in an unpublished form. Although there are obvious factors, such as the depression, that affect this correlation, the coefficient is sufficiently large to insure at least some positive relationship between exactly comparable data.

the average age of persons placed is a factor in average age of all persons engaged, and because the correlation is not perfect, differences in average duration of employment also probably help to account for the average age of persons gainfully employed.

Either one or both of these two factors explains the median age of each occupational group, some occupations being influenced more by one than by the other. Skilled occupations, as a group, are marked by long duration of employment. In contrast, the average age of watchmen, guards, doorkeepers, teamsters, expressmen, charwomen, and cleaners at the time of obtaining employment is already far advanced, and duration of employment is shorter than that of the average skilled occupation.

There is no consistent relationship between increase in number of workers in an occupation 1910–1930 and increase in median age ($r = -.19 \pm .09$ for males, and $-.01 \pm .12$ for females), although there are some occupations in which males declined in total numbers and also increased rapidly in age. Outstanding examples include:

| | Decline in Numbers 1910–1930 | Increase in Median Age 1910–1930 (years) |
|---|---|---|
| Locomotive engineers and firemen | 8,065 | 6.9 |
| Tailors | 21,220 | 7.9 |
| Operatives in cigar factories | 41,399 | 7.0 |
| Brakemen | 5,128 | 6.4 |
| Draymen, teamsters and expressmen | 299,050 | 7.9 |

Another important fact related to median age is revealed by these occupational data. Invariably, occupations that are fundamental to other occupations, that constitute the first steps in the employment ladder, have smaller median ages than those higher in the scale. Thus, most office boys (median age in 1930, 21.2 years) later become clerks (median age, 24.0); salesmen (median age, 30.2); or bookkeepers, cashiers and accountants (median age, 30.5). Many salesmen in turn become real estate and insurance agents (median age, 41.9), or wholesale and retail dealers (median age, 40.3). Although they are not included among the selected occupations of Table I, the same sort of differences exist between the median ages of farm laborers and farmers, and of apprentices and skilled workers.

Because of the depression, it is not likely that we can forecast with any degree of accuracy the future age trends in the occupations under discussion. Projection of trends beyond 1930 is likely to be meaningless in view of industrial codes under the New Deal, and other governmental regulations, and in view of the weakness of the economic struc-

ture after 1930. However, unless the whole system of American industrial democracy is changed to a revolutionary extent, the aging of the working population will continue for some time yet, almost certainly for at least two decades, and probably longer. There has been an unquestioned decline in the number of young persons in the population. The population pyramid is actually smaller at the bottom than formerly and this condition of affairs will automatically spread to the older group as the years pass. By 1940 it will already be affecting the youngest working groups. The increased length of schooling, child labor agitation and the probable loss of interest in gainful employment following a history of emergency relief and a large amount of chronic unemployment will serve to reduce drastically the number of workers below 20 at that time. By 1950, the effects of the declining number of births may be expected to reach the 20 to 30 year group, and the result will be further aging of workers in all occupations in which workers are not already as old as they can be and retain their efficiency. But by 1960, or 1970 at the latest, the decline in the birth rate will probably have had its greatest effect on the age of the working population—at least its greatest effect during the present phase of our national development. By the latter date the age of gainful workers in each occupation will be somewhat closer to the upper age limit of productive efficiency than now unless an interruption of recent trends occurs.

# NOTES

## ADJUSTMENT FOR THE INFLUENCE OF AGE COMPOSITION ON ESTIMATES BY BURKS'S METHOD OF THE DISTRIBUTION OF SIZES OF COMPLETED FRATERNITIES

By Frank Lorimer, *Population Association of America*

A method for estimating the distribution of the sizes and mean size of completed fraternities of children (including both living and deceased) was presented by Dr. Barbara S. Burks in this Journal, December, 1933.[1] A high degree of reliability for the estimates so obtained of mean size of completed fraternities for state populations is indicated by the correlation of such estimates with ratios of children to married women ($r = .894 \pm .020$), reported by Dr. Persis Putnam,[2] using data for native whites only, 1930. The distribution of sizes of completed fraternities in three states, obtained by application of Burks's formula, is reported by Lorimer and Osborn.[3] Curiosity regarding the possible influence on these values of variations in age distribution of females, resulting from population growth and interstate migrations, led the present author to carry out an experiment on this subject, with the results shown in Table I. The adjustment

TABLE I

ESTIMATED PERCENTAGE DISTRIBUTION OF COMPLETED FRATERNITIES AND AVERAGE SIZE OF COMPLETED FRATERNITY FOR SELECTED GROUPS OF NATIVE WHITES, 1930, BY BURKS'S FORMULA, WITH ADJUSTMENTS FOR DIFFERENCES IN AGE DISTRIBUTION OF WOMEN, 15–44 YEARS.

| Number of children in a completed fraternity | United States* | | North Carolina | | Indiana | | California | |
|---|---|---|---|---|---|---|---|---|
| | Crude | Adjusted | Crude | Adjusted | Crude | Adjusted | Crude | Adjusted |
| 1..... | 31.5 | 28.2 | 26.8 | 21.3 | 25.7 | 23.4 | 36.5 | 37.5 |
| 2..... | 25.4 | 24.9 | 20.1 | 18.1 | 24.8 | 24.4 | 31.8 | 31.5 |
| 3..... | 15.0 | 15.3 | 13.6 | 13.1 | 15.9 | 16.2 | 15.3 | 15.0 |
| 4..... | 9.1 | 9.7 | 9.4 | 9.6 | 9.9 | 10.2 | 7.0 | 6.8 |
| 5..... | 5.7 | 6.2 | 6.7 | 7.4 | 8.0 | 8.6 | 3.8 | 3.8 |
| 6 or more .. | 13.3 | 15.7 | 23.4 | 30.5 | 15.7 | 17.2 | 5.6 | 5.4 |
| Total.... | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Average size.. | 2.99 | 3.22 | 3.73 | 4.30 | 3.28 | 3.42 | 2.36 | 2.33 |

* Birth Registration Area, 1930

[1] "A Statistical Method for Estimating the Distribution of Sizes of Completed Fraternities in a Population Represented by a Random Sampling of Individuals," by Barbara S. Burks, Journal of the American Statistical Association, 38, 388–394.

[2] *See* Table 1 in *Dynamics of Population* by Frank Lorimer and Frederick Osborn (pp. 12–13).

[3] *See op. cit.*, pp. 280–281.

increases the average size of a completed fraternity by 8 per cent for the Birth Registration Area and by 15 per cent for North Carolina but makes no appreciable change for California. It increases by almost one half the difference between these states.

The steps used in this experiment are outlined in general form and illustrated below. The procedure is based on the assumption that the distribution of births by age of mother for each birth-order position in each population is similar to that in the general population. In order to simplify procedure, all births to mothers under 20 years of age are related to the age class of mothers, 15–19 years, and all births to mothers over 40 years of age are related to the age class of mothers, 40–44 years.

1. Select some "general population" for which birth statistics are available by age of mother for each order of birth. Find for each birth-order position the ratio of births to mothers in each age class to all births of that order. For example, the ratio of the number of first births to mothers 15 to 19 years of age to the total number of first births may be expressed as follows:

$$R_{I(15\text{-}19)} = B_{I(15\text{-}19)}/B_I$$

Table II shows these ratios for the native white population of the U. S. Birth Registration Area, 1930.

TABLE II

PERCENTAGE DISTRIBUTION, BY AGE OF MOTHER, OF BIRTHS OF EACH ORDER TO NATIVE WHITE MOTHERS, U. S. BIRTH REGISTRATION AREA, 1930

| Age of mother | Order of birth | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | All births | I | II | III | IV | V | VI | VII or later |
| Under 20... | 12.42 | 29.63 | 9.67 | 2.06 | 0.39 | 0.11 | 0.04 | 0.00 |
| 20–24..... | 31.37 | 43.23 | 42.75 | 32.58 | 18.97 | 7.97 | 2.90 | 0.59 |
| 25–29..... | 25.50 | 18.56 | 29.22 | 34.73 | 37.49 | 34.92 | 25.58 | 7.84 |
| 30–34..... | 16.90 | 6.23 | 13.16 | 20.35 | 26.50 | 32.80 | 38.12 | 28.46 |
| 35–39..... | 10.20 | 1.96 | 4.44 | 8.53 | 13.52 | 19.06 | 25.59 | 40.28 |
| 40 or over.. | 3.61 | 0.39 | 0.76 | 1.75 | 3.13 | 5.14 | 7.77 | 22.83 |
| Total.... | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

2. Find the "normal" age distribution of females at childbearing ages in an appropriate "standard population" corresponding to a given set of age-specific death rates. For example, Table III, Column 1, gives the percentage distribution by five-year age classes in a life table population of females aged 15–44 years, based on death rates in the U. S. Death Registration Area, 1919–1920.

3. Find the corresponding age distribution of females at childbearing ages in each population for which adjusted estimates of the average size of completed fraternities are to be secured. For example,

TABLE III

PERCENTAGE AGE DISTRIBUTION OF FEMALES AGED 15–44 YEARS IN "STANDARD POPULATION" (WHITES, 1919–1920) AND IN SELECTED GROUPS, NATIVE WHITES, 1930*

| Age | "Standard Population" | United States** | North Carolina | Indiana | California |
|---|---|---|---|---|---|
| 15–19..... | 17.9 | 21.6 | 23.6 | 20.1 | 17.0 |
| 20–24..... | 17.5 | 19.7 | 21.0 | 18.5 | 17.9 |
| 25–29..... | 17.0 | 16.9 | 17.1 | 16.7 | 17.3 |
| 30–34..... | 16.4 | 15.2 | 14.3 | 15.6 | 16.9 |
| 35–39..... | 15.9 | 14.5 | 13.2 | 15.3 | 16.7 |
| 40–44..... | 15.3 | 12.1 | 10.8 | 13.8 | 14.2 |
| Total ... | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

* Stationary white female population based on *United States Abridged Life Tables, 1919–1920*. *See* Lorimer and Osborn, *Dynamics of Population*, Appendix B. Other data from the Census.
** Birth Registration Area, 1930

see Table III, columns 2–5.

In each population under observation, including the "general population," find the ratio of the proportion of females in each age class to the corresponding proportion of females in the standard population. This ratio may be expressed for the $a$th population and mothers 15–19 years of age, for example, as follows:

$$K^a_{15\text{-}19} = P^a_{15\text{-}19}/P_{15\text{-}19}$$

where $P^a_{15\text{-}19}$ is the percentage of mothers 15 to 19 years of age in the $a$th population and $P_{15\text{-}19}$ is the percentage in the standard population.

4. For each population under observation, obtain an adjustment factor for each birth-order position by dividing the ratios obtained in step 1 by the corresponding ratios obtained in step 3 and summing the results for each order of birth. Thus, for the $a$th population and the first order of birth,

$$C^a_{\text{I}} = (R_{\text{I}(15\text{-}19)}/K^a_{15\text{-}19}) + (R_{\text{I}(20\text{-}24)}/K^a_{20\text{-}24}) + \ldots + R_{\text{I}(40\text{-}44)}/K^a_{40\text{-}44}).$$

TABLE IV

BIRTH ORDER CORRECTION FACTORS

| Population | $C_{\text{I}}$ | $C_{\text{II}}$ | $C_{\text{III}}$ | $C_{\text{IV}}$ | $C_{\text{V}}$ | $C_{\text{VI}}$ | $C_{\text{VII}}$ |
|---|---|---|---|---|---|---|---|
| U. S. Birth Registration Area. | 91.02 | 95.39 | 99.07 | 102.19 | 105.02 | 107.26 | 112.10 |
| North Carolina..... | 87.06 | 93.64 | 99.44 | 104.59 | 109.35 | 113.45 | 121.66 |
| Indiana..... | 95.22 | 98.11 | 100.26 | 101.91 | 103.25 | 104.17 | 105.60 |
| California..... | 100.06 | 98.57 | 97.96 | 97.77 | 97.74 | 97.74 | 98.86 |

5. Multiply the observed number of births of each order in each population by the corresponding birth-order adjustment factor for that group, thus obtaining an adjusted distribution of births classified by order of birth.

6. Apply the formulae developed by Burks to the adjusted distribution for each selected group.

# THE FACTOR ELIMINATION METHOD OF DERIVING A COEFFICIENT OF NET DETERMINATION [1]

By F. E. Wolfe, *Procter and Gamble Company*

There is a recognized need in quantitative economic research for a coefficient of net determination which is capable of consistent interpretation, and as sound theoretically as the coefficient of gross determination.[2] In analyzing data for the purpose of making forecasts of cotton acreage and prices of cottonseed products, the writer finds that the advantages of such a coefficient are: (a) as a tool, it aids in detecting, and eliminating relatively unimportant variables; (b) it indicates the relative weight of each factor as a determinant of changes in the dependent variable; and (c) it permits comparison of the relative stability of the factors in different periods and in various combinations.

It is the purpose of this paper to describe the method of factor elimination which was developed as a convenient process for deriving either graphically or arithmetically a coefficient of separate determination. The formula for deriving the coefficient by this method has the following functional characteristics:

1. It measures the contribution of each independent variable to the gross or total determination of the dependent variable.
2. It is applicable in multiple curvilinear correlations.
3. It yields net coefficients having a sum, $R^2$ or gross determination, which, plus the square of the coefficient of alienation equals 1.00.[3]
4. It yields net coefficients which have a value between zero and $R^2$ (hence the sign of the net coefficients must be positive).

The factor elimination method is essentially a procedure for deter-

[1] Acknowledgment is made of the valuable assistance of Lee M. Welsh, mathematical statistician of the Economic Research Department, Procter & Gamble Company.

[2] For a description of various measures of determination see, for example, the following: Ezekiel, Mordecai, "A Method of Handling Curvilinear Correlation," this Journal, Vol. XIX, pp. 431–453, December 1924; Bean, L. H., "A Simplified Method of Graphic Curvilinear Correlation," this Journal, Vol. XXIV, pp. 386–397, December, 1929; Ezekiel, Mordecai, *Methods of Correlation Analysis*, 1930; Tolley, H. R., Method described in *Adjusting Hog Production to Market Demand*, by F. F. Elliott, University of Illinois Agricultural Experiment Bulletin 293 (1927), pp. 554–557. Wright, Sewall, "Correlation and Causation," *Journal of Agricultural Research*, Vol. XX No. 7, pages 557–585. McCormick, Thomas C., "A Coefficient of Independent Determination," this Journal, Vol. XXIX, No. 185, March, 1934, pp. 70–71 and Vol. XXIX, No. 187, September, 1934, p. 319. Stouffer, Samuel A., "A Coefficient of 'Combined Partial Correlation' with an Example from Sociological Data," this Journal, Vol. XXIX, No. 185, March, 1934, pp. 70–71.

[3] The square of the coefficient of alienation measures the quantitative importance of the factors not included in any given study. It follows that the coefficients can be conveniently expressed in percentages. In this they are different from coefficients of correlation.

mining the "beta" coefficients quickly and easily in multiple curvilinear graphic analysis. Series of curves are derived by a method of curvilinear correlation which can be stated in the form

$$x_1 = b_2F_2(x_2) + b_3F_3(x_3) + b_4F_4(x_4) + \ . \ \ . \ \ . + b_nF_n(x_n)$$

where $F_i(x_i)$ is a function of $x_i$ representing the $x_i$ regression curve. By definition $\beta_i = b_i\sigma_i/\sigma_1$ and if the curves $F_i(x_i)$ . . . are accurately determined each coefficient, $b_i = 1.000$. Therefore we can immediately write $\beta_i = \sigma_{Fi(xi)}/\sigma_1$. In this case $\sigma_{Fi(xi)}$ is the standard deviation of readings from the curve $F_i(x_i)$ and $\sigma_1$ is the standard deviation of the dependent variable.

The relative weight of an independent factor is determined by eliminating it or by substituting a horizontal regression line for it in a new series of separate approximations, the remaining regression curves at the same time being held unchanged. This is a departure from the process of partial correlation in that only one of the regression curves of the independent variables is changed at a time. After the coefficient of gross determination, $R^2$, is computed and a horizontal line is substituted in a new approximation for the regression of the independent which is being eliminated, (1) a new set of estimates of the dependent variable, (2) a new set of residuals, and (3) a new set of squared residuals are obtained. The difference between the total of this new set of squared residuals and the total of squared residuals in the original approximation, or the difference in $R^2$, measures the importance of the particular variable. The steps are then repeated for each of the other independent variables.

In actual practice the procedure may be considerably shortened. If the $n$th approximation of a curvilinear multiple correlation of variables $X_1$, $X_2$, $X_3$, and $X_4$ is selected as representing the closest approximation to the true relationships, we have:

$$x_1 = x_{2n} + x_{3n} + x_{4n} + Z_n \qquad (1)$$

where $x_1$ is an observation in the dependent series measured as a deviation from the average, $x_{2n}$, $x_{3n}$ and $x_{4n}$ are readings from the $n$th approximation regression curves measured as deviations from the average, and $Z_n$ is the residual remaining when $x_1$ is estimated in the $n$th approximation.

If we now change the $X_2$ regression curve to a straight horizontal line, the $x_{2n}$ in equation 1 will become 0 and we will secure a new residual, $Z_{2n}$. The equation now becomes

$$x_1 = x_{3n} + x_{4n} + Z_{2n}$$

$$\text{or} \quad Z_{2n} = x_1 - x_{3n} - x_{4n} \qquad (2)$$

Adding (1) and (2):

$$Z_{2n} = x_{2n} + Z_n \tag{3}$$

Squaring and rearranging:

$$Z_{2n}^2 - Z_n^2 = x_{2n}^2 + 2x_{2n}Z_n \tag{4}$$

Summing the observation equations we have

$$\Sigma(Z_{2n}^2) - \Sigma(Z_n^2) = \Sigma(x_{2n}^2) + 2\Sigma(x_{2n}Z_n)$$

Since in the method of least squares independents are not correlated with residuals the last term must always equal zero. Therefore

$$\Sigma(Z_{2n}^2) - \Sigma(Z_n^2) = \Sigma(x_{2n}^2) = \Sigma(X_{2n}^2) - M_{X_{2n}}\Sigma X_{2n}$$

where $X_{2n}$ is a reading from the $X_2$ regression curve in the $n$th approximation (not a deviation from the average) and $M_{X_{2n}}$ is the mean of these readings.

Instead of going through the lengthy process of finding $\Sigma(Z_{2n}^2)$ and subtracting from it the $\Sigma(Z_n^2)$ we may take the very much shorter cut of squaring the $X_2$ regression readings and adjusting the total by the product of the mean and the sum of the $X_{2n}$ column.

The net determination of each independent is then found in the usual manner.

For example, the net determination of $X_2$ is

$$\frac{[\Sigma(X_{2n}^2) - M_{X_{2n}}\Sigma X_{2n}]\,R^2}{\Sigma(X_{2n}^2) - M_{X_{2n}}\Sigma X_{2n} + \Sigma(X_{3n}^2) - M_{X_{3n}}\Sigma X_{3n} + \Sigma(X_{4n}^2) - M_{X_{4n}}\Sigma X_{4n}}$$

In comparison with other methods, derivation of the coefficient by factor elimination is simply and easily done and conforms to the requirements of logical analysis and of sound mathematical procedure.

# A SIMPLIFIED METHOD OF DETERMINING MULTIPLE REGRESSION CONSTANTS

By Frederick V. Waugh, *U. S. Bureau of Agricultural Economics*

A number of standard textbooks on statistical method explain in detail the use of the Doolittle method of determining regression coefficients. Ezekiel's [1] book also explains a method of determining the standard errors of regression coefficients by an extension of the Doolittle process. Horst, in an article in this Journal [2] presented a general application of the Doolittle method for the determination of all the usual measures of regression with their standard errors, and the coefficients of partial and multiple correlation. Recently Frisch [3] has presented a systematic method of determining all necessary measures of regression and correlation not only in the entire set of $n$ variables but also in each subset of $n - 1$ variables; $n - 2$ variables; etc.

Frisch's method is to be preferred whenever a complete and detailed understanding of all relationships is necessary. However, the work involved in a problem of eight or ten variables is almost prohibitive and in many cases the most practical procedure will be; first, to determine the constants of regression and correlation in the entire set of $n$ variables; second, to test the significance of each variable and drop non-significant factors; and third, to recalculate the constants of regression and correlation in the smaller set of significant variables.

The writer prepared the following set of instructions governing the computation of multiple regression constants for use in the United States Bureau of Agricultural Economics. Statistical clerks have been able to follow the instructions as written and to solve for all the usual measures of regression and correlation. The process takes less than one and one-half times the time spent in the calculating of regression coefficient alone by the Doolittle method.

The process outlined here is a modification of Horst's process and the example is the one used by Horst to illustrate his method. Thus the method explained here is in no sense new but it is believed that certain changes which have been made in the Horst process simplify the computation somewhat, and make possible the saving of considerable time. These changes are as follows:

(a) The dependent variable (if the dependent variable can be

[1] M. J. B. Ezekiel, *Methods of Correlation Analysis*, John Wiley & Sons, New York, 1930.
[2] Paul Horst, "A General Method of Evaluating Multiple Regression Constants," this Journal, Vol. 27, 1932, p. 270.
[3] Ragnar Frisch, *Statistical Confluence Analysis by Means of Complete Regression Systems*, Publikasjon nr. 5, Universitets Økonomiske Institutt, Oslo, 1934.

chosen on a priori grounds) is placed in the first line and row of the $R$ matrix rather than in the last. The independent variables are arranged in what appears to be their order of significance. In other words, the dependent variable is called $x_1$ and placed first; the independent variable which appears to be most significant is placed second and called $x_2$; etc. If the variables can be accurately placed in the order of their significance the problem of dropping non-significant variables is simplified.

(b) The work of copying is reduced as far as possible and as much of the work as possible is done on the calculating machine. Horst's forms A, B, C, and D are condensed to one table, and his forms E, F, and G to one other table. The writer's experience is that by reducing the amount of copying and performing as much of the work as possible by machine the required time is reduced and the accuracy increased. Moreover, the results can be tabulated more compactly and are not cluttered up with unnecessary data used in computing results.

(c) Finally, the most important change made in Horst's process is that instead of calculating the value of zero order correlation determinant,

$$R = \begin{Vmatrix} r_{11} & r_{12} & \cdots & r_{1n} \\ r_{12} & r_{22} & \cdots & r_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ r_{1n} & r_{2n} & \cdots & r_{nn} \end{Vmatrix}$$

and the values of co-factors, $R_{ij}$, in the adjoint of $R$, we calculate the values of $R_{ij}/R$. These values are designated as $P_{ij}$. From the values of $P_{ij}$ it is possible to calculate all the usual measures of regression and correlation, and the $P_{ij}$ values can be determined more easily and quickly than can be values of $R$ and of the co-factors, $R_{ij}$.

Remembering the definition,

$$(1) \qquad P_{ij} = R_{ij}/R$$

and also that $r_{ii} = 1$ and that $r_{ij} = r_{ji}$, we can determine, for example, the values of $P_{i7}$ in a seven variable problem from the following simultaneous equations which are derived from the elementary mathematics of determinants.

$$\begin{aligned}
P_{17} + r_{12}P_{27} + r_{13}P_{37} + r_{14}P_{47} + r_{15}P_{57} + r_{16}P_{67} + r_{17}P_{77} &= 0 \\
r_{12}P_{17} + P_{27} + r_{23}P_{37} + r_{24}P_{47} + r_{25}P_{57} + r_{26}P_{67} + r_{27}P_{77} &= 0 \\
\cdots\cdots\cdots

When these equations are reduced by the Doolittle method we get two reduced $r_{ij}$ coefficients which are designated $r'_{ij}$ and $r''_{ij}$ in Table I.

TABLE I

REDUCTION OF EQUATIONS BY DOOLITTLE METHOD

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Check |
|---|---|---|---|---|---|---|---|---|
| $r_{1j}$ | 1. | .643 | .416 | .108 | .250 | — .210 | .063 | 2.270 |
| $r'_{1j}$ | 1. | .643 | .416 | .108 | .250 | — .210 | .063 | 2.270 |
| $r''_{1j}$ | —1. | — .643 | — .416 | — .108 | — .250 | + .210 | — .063 | —2.270 |
| $r_{2j}$ | | 1. | .383 | .078 | .241 | — .281 | — .004 | 2.060 |
| $r'_{2j}$ | —1.70488 | .58655 | .11551 | .00856 | .08025 | — .14597 | — .04451 | .60036 |
| $r''_{2j}$ | | —1. | — .19693 | — .01459 | — .13682 | + .24886 | + .07588 | —1.02359 |
| $r_{3j}$ | | | 1. | .128 | .708 | — .283 | .412 | 2.764 |
| $r'_{3j}$ | | —1.24347 | .80420 | .08139 | .58820 | — .16689 | .39456 | 1.70145 |
| $r''_{3j}$ | | | —1. | — .10121 | — .73141 | + .20752 | — .49062 | —2.11571 |
| $r_{4j}$ | | | | 1. | .079 | .032 | .280 | 1.705 |
| $r'_{4j}$ | | | —1.02044 | .97997 | — .00870 | .07370 | .23391 | 1.27888 |
| $r''_{4j}$ | | | | —1. | + .00888 | — .07521 | — .23869 | —1.30501 |
| $r_{5j}$ | | | | | 1. | — .219 | .650 | 2.709 |
| $r'_{5j}$ | | | —2.01519 | | .49623 | — .02381 | .35383 | .82625 |
| $r''_{5j}$ | | | | | —1. | + .04798 | — .71303 | —1.66505 |
| $r_{6j}$ | | | | | | 1. | .111 | .150 |
| $r'_{6j}$ | | | | | —1.13861 | .87826 | .19442 | 1.07266 |
| $r''_{6j}$ | | | | | | —1. | — .22137 | —1.22136 |
| $r_{7j}$ | | | | | | | 1. | 2.512 |
| $r'_{7j}$ | | | | | | —2.23259 | .44791 | .44792 |
| $r''_{7j}$ | | | | | | | —1. | —1. |

In terms of these reduced equations (2) can be written:

$$P_{17} = r''_{12}P_{27} + r''_{13}P_{37} + r''_{14}P_{47} + r''_{15}P_{57} + r''_{16}P_{67} + r''_{17}P_{77}$$

$$P_{27} = r''_{23}P_{37} + r''_{24}P_{47} + r''_{25}P_{57} + r''_{26}P_{67} + r''_{27}P_{77}$$

(3) . . . . . .

$$P_{67} = r''_{67}P_{77}$$

$$P_{77} = 1/r'_{77}$$

The values of $P_{i6}$, $P_{i5}$, etc., are calculated by a similar process which is illustrated in Table II. The final figure to be calculated is,

(4) $$P_{11} = r''_{12}P_{12} + r''_{13}P_{13} + r''_{14}P_{14} + r''_{15}P_{15} + r''_{16}P_{16} + r''_{17}P_{17} + 1/r'_{11}$$

The values $1/r'_{ii}$ are obtained in the usual Doolittle solution, and are entered (with the sign changed) to the left of the $r'_{ii}$ values.

TABLE II

TABLE OF $P_{ij}$ (IN THE SET 1234567)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | $\Sigma(P_{ij}r_{ij})$ |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.81930 | —1.02245 | — .42507 | — .07596 | .07820 | — .00895 | .02754 | 1.00000 |
| 2 | | 1.83452 | — .20928 | — .07334 | — .16713 | .17745 | .26794 | 1.00000 |
| 3 | | | 2.37207 | — .13979 | —1.49152 | .19711 | .03539 | 1.00000 |
| 4 | | | | 1.14350 | .38292 | .02777 | — .51007 | 1.00000 |
| 5 | | | | | 3.18696 | .41228 | —1.61562 | 1.00004 |
| 6 | | | | | | 1.24802 | — .49423 | 1.00000 |
| 7 | | | | | | | 2.23259 | 1.00000 |

Remembering the definition of $P_{ij}$ in (1) we can write Horst's equations 3, 4, 5 and 6 as follows:

(5) $R_{i.123\ldots)i(\ldots n} = \{1 - (1/P_{ii})\}^{\frac{1}{2}}$

(6) $r_{ij.123\ldots)i(\ldots)j(\ldots n} = -P_{ij}/(P_{ii}P_{jj})^{\frac{1}{2}}$

(7) $\beta_{ij.123\ldots)i(\ldots)j(\ldots n} = -P_{ij}/P_{ii}$

(8) $\sigma_{\beta_{ij.123\ldots)i(\ldots)j(\ldots n}} = \{(P_{ii}P_{jj} - P_{ij}^2)/n'P_{ii}^2\}^{\frac{1}{2}}$

where $n'$ represents the number of observations minus the number of variables: that is, $n'$ is the number of degrees of freedom in the problem.

$$R_{1.234\ldots n} = \{1 - (1/P_{11})\}^{\frac{1}{2}} = .671$$

$$r_{1j.234\ldots)j(\ldots n} = -P_{1j}/(P_{11}P_{jj})^{\frac{1}{2}} = -.74139P_{1j}/(P_{jj})^{\frac{1}{2}}$$

$$\beta_{1j.234\ldots)j(\ldots n} = -P_{1j}/P_{11} = -.54966\ P_{1j}$$

$$\sigma\beta_{1j.234\ldots)j(\ldots n} = \{(P_{11}P_{jj} - P_{1j}^2)/n'P_{11}^2\}^{\frac{1}{2}}$$

$$= \{.30213\ (1.81930\ P_{jj} - P_{1j}^2)/n'\}^{\frac{1}{2}}$$

| | | | |
|---|---|---|---|
| $\beta_{12.34567} =$ | $.562 \pm .832/\sqrt{n'}$ | $r_{12.34567} =$ | $.560$ |
| $\beta_{13.24567} =$ | $.234 \pm 1.142/\sqrt{n'}$ | $r_{13.24567} =$ | $.205$ |
| $\beta_{14.23567} =$ | $.042 \pm .792/\sqrt{n'}$ | $r_{14.23567} =$ | $.053$ |
| $\beta_{15.23467} =$ | $-.043 \pm 1.323/\sqrt{n'}$ | $r_{15.23467} =$ | $-.032$ |
| $\beta_{16.23457} =$ | $.005 \pm .828/\sqrt{n'}$ | $r_{16.23457} =$ | $.006$ |
| $\beta_{17.23456} =$ | $-.015 \pm 1.108/\sqrt{n'}$ | $r_{17.23456} =$ | $-.014$ |

The coefficient of part determination [4] can be calculated also from the $P_{ij}$ values by the following equation:

(9) $${}_{ij}r_{\ 123\ldots)i(\ldots)j(\ldots n} = \{P_{ij}^2/(P_{ij}^2 + P_{ii})\}^{\frac{1}{2}}$$

The $\beta$ coefficients and their standard errors are calculated in terms of standard units because of the fact that the solution is based on the zero order coefficients $r_{ij}$. If it is desired to reconvert them to their original units, they should be multiplied by the factor $\sigma_i/\sigma_i$.

It is also possible to calculate these values directly by starting with the product moments, $m_{ij}$, instead of the correlation coefficients, $r_{ij}$. The $r_{ij}$ coefficients usually will be preferable because the variables can be more easily arranged in the order of their significance and because the same number of decimal places can be maintained throughout. However, if the $m_{ij}$ values are used the values of $b_{ij.123\ldots)i(\ldots)j(\ldots n}$ and of $\sigma b_{ij.123\ldots)i(\ldots)j(\ldots n}$ can be obtained by the same formulas (7 and 8) used in calculating the values of $\beta_{ij.123\ldots)i(\ldots)j(\ldots n}$ and $\sigma\beta_{ij.123\ldots)i(\ldots)j(\ldots n}$

[4] For a discussion of this coefficient see Ezekiel, *op. cit.*, chapter 13 and appendix 2, note 9.

from the table of $r_{ij}$. The coefficients of partial correlation and multiple correlation could also be calculated from such a solution but if these values are wanted it is easier to use the $r_{ij}$ values.

The following pages give the instructions prepared for use in the United States Bureau of Agricultural Economics and an example which will be of help in following the mechanics of computation.

## INSTRUCTIONS FOR SOLVING MULTIPLE REGRESSION PROBLEMS

The attached example illustrates a simple method of calculating coefficients of net regression with their standard errors together with coefficients of partial and multiple correlation. The steps in this process are as follows:

(1) First, set up the zero order correlation matrix,

$$R = \begin{Vmatrix} r_{11} & r_{12} & . & . & . & r_{1n} \\ r_{21} & r_{22} & . & . & . & r_{2n} \\ . & . & . & . & . & . \\ r_{n1} & r_{n2} & . & . & . & r_{nn} \end{Vmatrix}$$

. It will be most convenient to place the dependent variable first, calling it $x_1$, and to arrange the independent variables in the order of their apparent significance. The most significant variables are those which are highly correlated with $x_1$ but not highly correlated with other variables in the problem. In the attached example $x_4$ was put ahead of $x_5$ and $x_6$ in spite of its lower correlation which $x_1$ because the correlations between $x_4$ and the other independent variables are significantly lower than are the correlations between $x_5$ and $x_6$ with the other independent variables.

(2) Enter in a column to the right of $R$ the check sums, $r_{i1} + r_{i2} + r_{i3} + r_{i4} + \ . \ . \ . + r_{in}$.

(3) Proceed to reduce the successive lines of $R$ by the Doolittle method. The reduced lines $r'_{ij}$ can be obtained directly on the calculating machine without copying the intermediate steps. Each figure in the reduced lines $r'_{ij} = r_{ij} + r''_{1i} r'_{1j} + r''_{2i} r'_{2j} + \ . \ . \ . + r''_{(i-1)i} r'_{(i-1)j}$. For example $r'_{57} = r_{57} + r''_{15} r'_{17} + r''_{25} r'_{27} + r''_{35} r'_{37} + r''_{45} r'_{47}$. The sum of the reduced line $r'_{ii} + r'_{(i+1)(i+1)} + \ . \ . \ . + r'_{nn}$ should equal the reduced check sum. If there is an error in the last decimal place the reduced check sum should be changed to equal the sum of the line.

The second reduced line $r''_{ij} = -r'_{ij}/r'_{ii}$. Enter at the left of $r'_{ii}$ the value $-1/r'_{ii}$ and multiply the $r'_{ij}$ line by this value.

Continue this process through the entire set of $n$ lines.

(4) The values, $P_{ij}$, are obtained from a back solution of the table

above. First, $P_{77} = 1/r'_{77}$, or the reciprocal opposite $r'_{77}$ with the sign unchanged.

$P_{67} = r''_{67}\, P_{77}$; $P_{57} = r''_{56}\, P_{67} + r''_{57}\, P_{77}$;
$P_{47} = r''_{45}\, P_{57} + r''_{46}\, P_{67} + r''_{47}\, P_{77}$;
$P_{37} = r''_{34}\, P_{47} + r''_{35}\, P_{57} + r''_{36}\, P_{67} + r''_{37}\, P_{77}$;
$P_{27} = r''_{23}\, P_{37} + r''_{24}\, P_{47} + r''_{25}\, P_{57} + r''_{26}\, P_{67} + r''_{27}\, P_{77}$;
$P_{17} = r''_{12}\, P_{27} + r''_{13}\, P_{37} + r''_{14}\, P_{47} + r''_{15}\, P_{57} + r''_{16}\, P_{67} + r''_{17}\, P_{77}$

This gives the column $P_{i7}$. Proceed to the column $P_{i6}$, as follows:

$P_{66} = 1/r'_{66} + r''_{67}\, P_{67}$; $P_{56} = r''_{56}\, P_{66} + r''_{57}\, P_{67}$
$P_{46} = r''_{45}\, P_{56} + r''_{46}\, P_{66} + r''_{47}\, P_{67}$; etc.

The $P_{i5}$ column is:

$P_{55} = 1/r'_{55} + r''_{56}\, P_{56} + r''_{57}\, P_{57}$;
$P_{45} = r''_{45}\, P_{55} + r''_{46}\, P_{56} + r''_{47}\, P_{57}$; etc.

Complete the $P_{ij}$ table by a continuation of the same process.

Check: As each $P_{ij}$ column is finished calculate $\Sigma_j P_{ij} r_{ij}$ (e. g., $P_{17} r_{17} + P_{27} r_{27} + P_{37} r_{37} + P_{47} r_{47} + P_{57} r_{57} + P_{67} r_{67} + P_{77} r_{77}$, etc.). Each sum should equal 1. As a further check any $P_{ij}$ column may be multiplied by any other column in the $R$ table, such as $r_{kj}$, (e.g., $P_{17} r_{16} + P_{27} r_{26} + P_{37} r_{36} + P_{47} r_{46} + P_{57} r_{56} + P_{67} r_{66} + P_{77} r_{67}$). These sums should each equal zero.

(5) All the usual measures of regression and correlation can be readily obtained from the $P_{ij}$ table. The regression coefficients (in standard units) are $\beta_{ij.12\ldots)i(\ldots)j(\ldots n} = -P_{ij}/P_{ii}$. All $n$ elementary regressions can be obtained from the table. The regression equation with $x_1$ as dependent is found by multiplying the top line of the $P_{ij}$ table by $-1/P_{11}$; the regression equation with $x_2$ as dependent is found by multiplying the second line of the $P_{ij}$ table by $-1/P_{22}$; etc.

The standard error of the regression coefficients is

$$\sigma\beta_{ij.12\ldots)i(\ldots)j(\ldots n} = \{(P_{ii}\, P_{jj} - P_{ij}^2)/n' P_{ii}^2\}^{\frac{1}{2}}$$

That is, for example, $\sigma\beta_{12.34567} = \{(P_{11}\, P_{22} - P_{12}^2)/n'\, P_{11}^2\}^{\frac{1}{2}}$; etc., where $n'$ is the number of observations minus the number of variables.

The partial correlation coefficients

$$r_{ij.12\ldots)i(\ldots)j(\ldots n} = -P_{ij}/(P_{ii}P_{jj})^{\frac{1}{2}};$$

that is, for example, $r_{12.34567} = -P_{12}/(P_{11}P_{22})^{\frac{1}{2}}$; etc.

The multiple correlation coefficient

$$R_{i.123\ldots)i(\ldots n} = \{1 - (1/P_{ii})\}^{\frac{1}{2}};$$

for example, $R_{1.234567} = \{1 - (1/P_{11})\}^{\frac{1}{2}}$; $R_{2.134567} = \{1 - (1/P_{22})\}^{\frac{1}{2}}$;

(6) Note: the regression coefficients and their standard errors calculated from the table of zero order correlation coefficients are in standard units. To reconvert them into original units, multiply them by $\sigma_i/\sigma_j$.

That is, for example,

$$b_{12.34567} = (\sigma_1/\sigma_2)\ \beta_{12.34567}$$
$$\sigma b_{12.34567} = (\sigma_1/\sigma_2)\sigma\beta_{12.34567}.$$

(7) If any of the regression coefficients are of a magnitude less than twice their standard error they are non-significant. Whenever some of the regression coefficients are non-significant the equation should be recalculated eliminating the non-significant variables. This can be done fairly easily if the variables were placed in the order of their significance before the Doolittle solution was carried out. In the present example the variables $x_6$ and $x_7$ are both non-significant unless the number of observations exceeds 21,832. The variables $x_4$ and $x_5$ are significant if the number of observations exceeds 3,794. Assuming that in this case $n = 5{,}000$, the variables $x_6$ and $x_7$ should be dropped and a new set of constants calculated for the set 12345. This can be done by calculating a new $P_{ij}$ table in the set 12345. The table in this set is shown in Table III. In this instance, $P_{55} = 1/r'_{55}$ and the other $P_{ij}$ values are determined by a back solution similar to that indicated above. For example: $P_{45} = r''_{45}\ P_{55}$; etc. Assuming that $n = 5{,}000$ all four regression coefficients; $b_{12.345}$, $b_{13.245}$, $b_{14.235}$, and $b_{15.234}$ are significant and these values should be used in preference to $b_{12.34567}$, etc.

TABLE III

TABLE OF $P_{ij}$ (IN THE SET 12345)

| | 1 | 2 | 3 | 4 | 5 | $\Sigma(P_{ij}r_{ij})$ |
|---|---|---|---|---|---|---|
| 1 | 1.81875 | —1.02504 | — .42499 | — .06987 | .09876 | 1.00000 |
| 2 | | 1.75324 | — .25615 | .00558 | .01464 | 1.00000 |
| 3 | | | 2.33462 | — .11638 | —1.47574 | 1.00000 |
| 4 | | | | 1.02060 | .01789 | 1.00001 |
| 5 | | | | | 2.01519 | 1.00000 |

# THE ACTIVITIES OF THE DIVISION OF CURRENT BUSINESS STATISTICS OF THE CENTRAL STATISTICAL BOARD

The Central Statistical Board was organized in August 1933, in acordance with Executive Order No. 6225. The functions of the Board were to promote the coordination, development and improvement of statistics, collected by Government agencies, required in carrying out the purposes of the National Industrial Recovery Act and to promote economy in their collection.

In line with these broad purposes, the Board early in 1934 inaugurated a joint program for the improvement of current statistics on employment, payrolls and man-hours in codified industries and trades. A Committee on Industries under Codes was set up in response to an order of the Administrator for Industrial Recovery requiring establishments operating under codes to report certain types of labor data to the Bureau of Labor Statistics and cooperating Federal and State agencies. A representative of this committee enlisted the cooperation of a number of coded industries in securing current reports on labor data and in extending coverage of the industries.

Appreciating the need for the systematic development of current statistical information on labor, sales, production, stocks and prices over a wide range of industries, the Central Statistical Board, in December 1934, solicited the cooperation of the National Industrial Recovery Board in the creation of a coordinating committee to function in this connection. As a result of this effort, a Federal Committee on Business Statistics, consisting of representatives of the National Industrial Recovery Board, the Department of Commerce, the Department of Labor, and the Central Statistical Board, was organized by the Central Statistical Board in February 1935.[1] Under the direction of this Committee, the Central Statistical Board established in March 1935, a separate division of its staff, entitled the Division of Current Business Statistics. The Division commenced its work on March 16.

In broad outline, there have been three major functions of the Division of Current Business Statistics:

1. To plan standard current reporting programs for at least major industries.

2. To negotiate on behalf of the participating Federal agencies with code authorities, trade associations, and individual firms in setting up the reporting program for current business statistics.

3. To advise all participating agencies on their conduct of the current reporting services involved in carrying out this program.

In carrying out the first of these functions, the Division has experienced

[1] The original membership of this Committee consisted of Messrs. Leon Henderson, John Dickinson, Isador Lubin and Morris A. Copeland, representing respectively the National Industrial Recovery Board, the Department of Commerce, the Department of Labor, and the Central Statistical Board. Since its inception, Mr. Leon Marshall has replaced Mr. Henderson; Mr. Ernest G. Draper has replaced Mr. Dickinson; and Mr. William J. Carson has replaced Mr. Copeland.

three distinct types of situations in respect to adequate current business information, and each of these has presented unique problems of policy and technique:

a. *Duplicate statistical series.* Soon after its organization, the Division assumed the operations formerly undertaken by the Committee on Industries under Codes. One of these related to the study of statistical information in industries in which there were two or more current series which duplicated one another. This situation was particularly acute in the field of labor data.

In the administration of the National Industrial Recovery Act, adequate current information on employment, payrolls, man-hours, and other related data was essential. Realizing this need, and in an effort to avoid duplications in reporting and publishing these data, the United States Bureau of Labor Statistics was designated by the Administrator for Industrial Recovery to collect this type of information from industries under codes. However, subsequent experience showed that in a number of important industries the labor statistics collected by the Bureau of Labor Statistics were duplicated by similar statistics collected by other agencies. The result was that industrial concerns were canvassed frequently with questionnaires from different agencies for substantially the same types of information. An undue reporting burden was thereby placed on industry and many serious complaints were raised. The burden of reporting labor data was particularly heavy and similar situations developed with reference to other data.

b. *Important gaps in current statistics.* In contrast to the problem of eliminating duplication is the task of filling important gaps in our present body of current business statistics. At present, our current information on retail trade is inadequate for the purpose of constructing a comprehensive picture of retailing for the country as a whole. Current statistics on actual operations in the construction industry are far from satisfactory. Adequate current data on commodity stocks on hand are not available for all industries. In some industries current production and labor data are based on inadequate sample reports, while in others they cover large concerns more completely than they do small firms. These and other forms of inadequacy in current business statistics have engaged the interest of the Division of Current Business Statistics since its inception.

It has been the policy of the Division to take an active part in setting up statistical series which fill some of these important gaps, and to develop them through the difficult experimental stages incident to establishing such series. In such undertakings, the Division first makes a careful study of available statistics in the particular field to be surveyed to determine precisely what the unfilled needs are and to avoid duplicating information already being collected. Next, the Division solicits the cooperation of all interested agencies in compiling a central mailing list which covers as adequately as possible all concerns currently engaged in the field. Third, the general scope of the inquiry is worked out, and within this scope the technical form of the questionnaire to be used is drawn up. In this phase of the undertaking, the needs of the industry and of other interested parties

are considered. The ability of the different concerns in the industry to furnish the detailed information desired is studied and the financial burden on the statistical agency that eventually is to take over the series is also reviewed.

After these details are perfected and a new series is inaugurated, the Division has found it necessary for a short period to study the response of the industry. The mailing list frequently needs revision, and the questionnaire often needs to be changed to conform more closely to the requirements of the industry.

While the work of the Division incident to planning and inaugurating a new current series is undertaken by its own staff, it is the policy of the Division not to collect statistical information itself. It contemplates turning over to the most appropriate operating statistical organization already in existence each new series that is developed just as soon as it is carried through the experimental formative stages and is established.

In the part of its work related to filling important gaps in current business information, the Division has been concerned from the first in two particular fields: retail sales and building construction.

In attempting to develop information relating to retail sales, the Division soon after its inception cooperated actively with the Bureau of Foreign and Domestic Commerce of the Department of Commerce in the preliminary steps incident to inaugurating a reporting program. The Bureau succeeded in establishing a new series in August 1935, covering the current changes in the dollar volume of sales in independent retail stores in Illinois, Indiana and Wisconsin. The Bureau has plans nearing completion for similar series for Texas, New Mexico, and Oklahoma, in cooperation with the Bureau of Business Research of the University of Texas. It is developing a cooperative plan with the Bureau of Business Research of the University of Denver looking toward the establishment of retail sales series in Colorado and Wyoming, and a similar plan for a series in Ohio in cooperation with the Bureau of Business Research of Ohio State University. In building up its reporting samples for these series, the Bureau of Foreign and Domestic Commerce through its Washington and district offices establishes field contacts by correspondence, while the cooperating universities are responsible for personal contacts with individual retail stores in their immediate territory. The Bureau looks eventually to retail sales series of this sort in all 48 states.

c. *Coordination of current statistics.* The third type of situation which the Division of Current Business Statistics has experienced in planning the current reporting program for industry relates to industry reports on different classes of information which are not on comparable bases.

The need for coordinated statistics is emphasized by the difficulties that arise at the present time because of the lack of comparability of different statistical series. For example, current production statistics frequently cover the entire calendar month, while the data on employment, payrolls and man-hours for the same industries cover a one-week sample period each

month. In such cases, serious limitations are presented to the user of statistics who attempts to make significant measurements of relations between labor-hours and labor-costs on the one hand and production on the other. Again, the commodity classifications of current production or sales data are sometimes different from those used in bench-mark data of the census type collected at less frequent intervals, and it is therefore difficult to align current data on a sample basis with comprehensive data covering the entire industry. Another instance suggesting the need for coordination of business statistics relates to the collection of data on different sampling bases in various industries, as illustrated by the unequal coverage of different industry groups in the same field of information. Area breakdowns used in different types of statistics or for different industries are not always comparable. In these and in many other respects, the Division has recognized the need for coordinating various current statistical series.

One example of its efforts to promote the coordination of statistics may be mentioned. The Division arranged a series of conferences with representatives of the Bureau of the Census, other Government agencies and in some cases with representatives of industry, to study differences in commodity classifications covered in the monthly statistics of the Bureau of the Census and in the biennial Census of Manufactures. As a result, recommendations for greater comparability in these statistics are now being incorporated in the schedules as they are being revised for use in 1936.

In its efforts to plan the current reporting program for industries, the Division of Current Business Statistics has entered into numerous negotiations with participating statistical agencies of the Federal Government, with trade associations, and with individual concerns. In these negotiations, the guiding principle has been to provide a ready opportunity to users and collectors of current business statistics to exchange their views and express their needs and problems. The Division has aimed to notify interested organizations, both private and governmental, of the development of these negotiations at each important stage, so that their opinions may be given consideration while plans are in the formative stage.

In conclusion, a concrete example of the work of the Division of Current Business Statistics will serve to illustrate the problems faced and techniques employed by the Division. The establishment of new series on employment, payrolls, man-hours and value of materials in the Private Construction Industry may be taken as representative.

For some years, the United States Bureau of Labor Statistics has had series covering employment, hours, and earnings reported by about ten thousand contractors engaged in the Private Construction Industry. The figures published by that Bureau are based upon reports covering the pay period ending nearest the 15th of each month; no breakdowns by occupations or by types of construction are shown. The Bureau also has series on employment, payrolls, man-hours, and value of material orders placed for construction projects financed by public funds. These series are based upon

reports furnished by contractors engaged on such projects and covering the period from the 15th of one month to the 15th of the next month. Breakdowns are shown by principal types of construction.

Under its administration, the Construction Code Authority recognized the need for more comprehensive coverage of the Private Construction Industry and also for occupational data by the major branches of that Industry. Late in 1934, it proposed a statistical program embracing labor data based on more complete reports covering information on skilled, semi-skilled and common labor in each division of the Construction Industry.

In setting up this program, a representative of the staff of the Central Statistical Board worked in close cooperation with the Construction Code Authority. After considerable negotiation, a questionnaire was cleared with all interested government agencies and an arrangement was worked out with the Division of Special Tabulations of the Bureau of the Census for editing and tabulating the information on the schedule. The Construction Code Authority, however, had no consolidated mailing list covering the several branches of the Industry, and in mailing the schedules for January 1935, it was necessary to send envelopes and blank schedules to the offices of the 17 Divisional Codes. As a result of this, the mailing of the 116,000 schedules for January was delayed until the middle of February, and was not completed until late in March. Partly as a result of this delay, and partly because of the fact that the contractors were not familiar with government reports, only 17,000 schedules were returned, of which only about 8,200 were useable reports.

In view of the technical difficulties thus incurred in mailing schedules, the mailing for February and March was restricted to the group of contractors who reported in January. Schedules for those months were sent at the same time, and were mailed by the Division of Special Tabulations of the Bureau of the Census. Of the schedules mailed, about 6,200 were returned by contractors, of which 3,400 were tabulated in the final reports.

Meanwhile, the Division of Current Business Statistics, which had taken over this phase of the Board's activities, and also the Construction Code Authority realized that the series could not be continued on this basis and that it was essential to have a complete consolidated mailing list in some government office which was responsible for developing the series. After some negotiation between the Division and the Code Authority, arrangements were made for the establishment of a consolidated mailing list in the Division, the Code Authority agreeing to request all of its Divisional offices to send in their mailing lists.

This list, now substantially complete, is the first consolidated mailing list for the Private Construction Industry. In building it up, duplications among the Divisional Code lists were eliminated, duplications of names already on the list currently surveyed by the Bureau of Labor Statistics were excluded and stencils were cut, corrected and made available for current use.

The consolidated list was first used in the collection of data on employment, wages, hours, and material orders delivered, for the reporting period

between June 15 and July 15, the Division of Current Business Statistics being responsible for the mailing and preliminary editing and the Bureau of Labor Statistics undertaking the final editing and tabulation. For the June–July period, about 45,000 schedules were mailed, and approximately 10,000 reports returned. In the July–August period, about 53,000 schedules were mailed, the return amounting to about 21,000.

In the middle of September, this new series was turned over completely to the Bureau of Labor Statistics. Arrangements were made to continue the series during the Winter months on the basis of the sample which had reported during June, July and August: that is, about 25,000 contractors. Studies will be made to determine from the reports what geographic areas and what branches of the industry are inadequately represented. Comparisons of fluctuations in the new series with those in the series already published will be studied, with a view to determining the relative qualities of the samples covered and also the reliability of the sample-period reports now used in the current series on private construction published by the Bureau.

Upon the basis of this information, the Bureau contemplates canvassing the entire list of contractors early in the Spring, and to build up the reporting samples in areas and branches of the industry now inadequately covered. Changes may be made at that time in the form of the schedule to conform more closely to the requirements of the industry and with the ability of contractors to furnish specific types of information. After this developmental and experimental period is over, it is anticipated that the new series will be combined with those already published by the Bureau on privately financed construction.

In the development of this new series, it should be pointed out that the series now being published by the Bureau of Labor Statistics were not in any way duplicated or interfered with. The tabulations of the new series will continue to be separate from the other series until such time as the list is perfected and the reporting sample increased and stabilized, thereby allowing the new series to reach a satisfactory stage of development without in any way affecting the historical value of series already established. Also, the Division of Current Business Statistics has been able to cooperate with an operating statistical agency in fostering the new series and eventually to turn over the series to that agency without duplicating the activities of any organization and without itself becoming an operating statistical unit.

The development of this project epitomizes the problems which the Division has faced in its operations and the policies and techniques it has employed in carrying out its major functions.

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# THE DEVELOPMENT OF INDUSTRIAL APPLICATIONS OF STATISTICAL THEORY IN POLAND

I am most grateful to the Editor for the kind suggestion to write the present account of activities of the Polish statisticians in the field of industry.

Since Poland is essentially an agricultural country, it is natural that the first attempts to apply statistical methods were made in agriculture. As far as I know the first work of this kind was undertaken in the last decade of the past century by the late Professor Edmund Załęski, a chemist and a plant breeder. His work resulted *inter alia* in obtaining varieties of sugar beet, which under suitable climatic conditions are among the sweetest in the world.

Systematic work in statistical methods applicable in industry started in 1924 when a small Statistical Laboratory was founded at the Central College of Agriculture, Warsaw. In 1928 the Biometric Laboratory was established at the Nencki Institute by the Soc. Sci. Litt. Varsoviensis. The two laboratories are in the same building,[1] are directed by the same person and must be really considered as one unit, which I will call the Warsaw Laboratories for short. For a couple of years the Warsaw Laboratories were practically the only source in Poland of statistical methods applicable in industry. Therefore, the present account will deal primarily with the activities of Warsaw Laboratories. They fall under the following headings: (a) statistical theory, (b) applications to agricultural experimentation, (c) applications in industries connected with agriculture (brewing, milk and cheese industry, seed breeding and testing, etc.), (d) chemical engineering, (e) economics, social science, etc., which falls beyond the limits of the present account.

(a) It is obvious that success in applications of statistical methods depends on the development of statistical theory to which, therefore, we devoted most of our efforts. The authors of the papers under this heading are: Miss K. Iwaszkiewicz (extension of partial correlation method to the case when one of the variables is not measurable), St. Kołodziejczyk (several important papers on testing hypotheses), W. Kozakiewicz (limiting distribution of several means of correlated variables) and myself. Personal friendship and common scientific interests resulted in a series of my joint papers with Professor E. S. Pearson of London, published both in England and in Poland. Theoretical papers of Polish authors are mostly published in international languages and are therefore accessible to American readers.

The above concerns pure statistical theory. The methods of application were usually developed in connection with some practical work carried out in other institutions, which will be quoted below.

(b) The applications of statistical methods to problems of agricultural experimentation worked out in the Warsaw Laboratories originated from cooperation with the late Professor E. Załęski of Kraków University and

[1] Central College of Agriculture, Rakowiecka 8, Warsaw, Poland.

Professor M. Górski of the Institute for Soil Management, Central College of Agriculture, Warsaw. The latter methods concern the results of "multiple" trials, carried out in different localities and different years. The account of the progress in the statistical technique attained is now being published in a joint paper by K. Iwaszkiewicz, St. Kołodziejczyk and myself in the *Supplement to the J.R.S.S.*, Vol. II.

(c) The applications to problems of brewing and milk industry are mainly due to two bacteriologists, T. Matuszewski and his young but brilliant Fellow, Miss J. Supińska, both working in the Research Institute of Fermentation Industry under Professor W. Dąbrowski. Most of the papers are in Polish, but there are comprehensive summaries in other languages. Besides there is a recent English paper published in the *Supplement to the J.R.S.S.*, Vol. II, and a French one in *Le Lait*.

The applications to seed testing and similar laboratory analyses and also to problems of agricultural experimentation are being worked out by Professor J. Przyborowski of Kraków. Being an Agriculturist, he started his statistical career by cooperating with the Warsaw Laboratories, but then rapidly acquired both the knowledge of the existing statistical theory and the aid of one of our mathematical colleagues, Mr. H. Wileński, and since is engaged in founding an independent statistical center in the Department of Plant Breeding, University of Kraków. The two authors contributed recently joint methodological papers published in the *Polish Agricultural and Forestry Journal*, in *Comptes Rendus* and *Biometrika*.

(d) We have on record only one paper concerning statistical methods in chemical engineering. This has been written by myself and was stimulated by the very interesting book of Dr. W. A. Shewhart. The paper deals with a problem in which the application of partial regression permitted the investigator both to detect the cause of excessive variation in quality of manufactured product and to indicate an effective method of checking the same. The method consists in adjusting the controllable factors in the process of manufacturing (such as temperature) to the varying properties of raw material.

The papers prepared by the staff and the collaborators of the Warsaw Laboratories are periodically collected in volumes called "Statistica" and are being sent in exchange for similar publications of other institutions.

Besides the centers in Warsaw and in Kraków mentioned, there are in Poland several others in which statistical methods are developed and applied to problems of anthropology, social science, business cycles, population problems, etc. There are also other institutions in which available statistical methods are applied. However, the achievements in these fields lie beyond the limits of the present account.

J. NEYMAN

University College, London

# ON THE APPLICATION OF MATHEMATICAL STATISTICS AND THE THEORY OF PROBABILITY IN THE INDUSTRIES OF THE SOVIET UNION

Mathematical statistics and the Theory of Probability which have reached a high degree of development in the works of Soviet scientists, have been applied here for some time in Soviet industry. Moscow is the chief center where these scientific developments and applications have been taking place.

Since March 1935, the Commission on the Application in Industry of Mathematical Statistics and the Theory of Probability began to function under the chairmanship of Professor E. E. Slutski and under the auspices of the Mathematical Research Institute of the First Moscow State University. The eight sessions which took place before the summer recess were devoted to the reading and discussion of a number of papers of an organizational and special character concerning: unevenness of weaving as a problem of prediction; utilization of statistics in determining technical standards; statistical problems in computing the insulation of electrical and other machines, cables, etc.; technical problems, requiring the application of statistical methods and a few papers dealing with current literature on mathematical statistics and the Theory of Probability.

The Secretary of this Commission, Mr. V. P. Levinsky, has been engaged in work on the application of mathematical statistics in the bulb laboratory of the "Electroplant" (Moscow). An investigation has been completed concerning the inefficiency of a "cracked retort" (the characteristic features of this inefficiency on fast and slow-moving equipment and the qualities of glass of various glass plants) and a new investigation is in process now concerning the methods of selecting bulbs for experimental purposes and ensuring their quality. A similar investigation is conducted now in the electric bulb plant "Svetlana." However, in this case the work proceeds along more elementary lines. At the present time, attempts are being made to employ more modern and refined methods of statistical analysis. In the "Electro-steel" plant (city of Noginsk, near Moscow) statistical methods were used in the laboratories with a view of ascertaining the effects of chromium upon the magnetic properties of steel.

Mr. V. P. Levinsky and Mr. L. A. Byzov, the latter a specialist in graphic methods, have just been commissioned to visit the "Sickle and Hammer," "Rollerbearing," "Precision" plants and the Stalinogorsk Chemical Combine, in order to introduce and assist in the practical application of mathematical statistics. Mr. Levinsky is conducting a smaller investigation, dealing with the utilization of mathematical statistics in telegraphy, where a number of questions have arisen, the solution of which demands the application of the Theory of Probability. (Fluctuation of time intervals, required for making various connections, distribution of technical stops according to time, etc.). The Council of Factory Laboratories of Moscow has decided to set up a

commission this fall for the purpose of working out methods of applying the Theory of Large Numbers in the field of technology.

The application of mathematical statistics and the Theory of Probability in industries is being carried on in many other cities of the Soviet Union. Thus, for instance, there may be cited the case of the city of Ivanovo-Voznesensk, the largest textile center in the Soviet Union, where the Textile Institute offers a special course in mathematical statistics. (See Professor Boev's book, "Mathematical Statistics for Textile-Men, 1933").

In the fall of 1934 the Middle Asiatic State University and Industrial Institute of Tashkent organized, under the leadership of Professor V. I. Romanovsky, a Research Seminar devoted to the matter of applying mathematical statistics in industry. The purpose of the Seminar is to carry on research work, as well as to train instructors in mathematical statistics and in the Theory of Probability for the higher schools of engineering and technology. During the academic year of 1934–35 the theoretical work of the Seminar consisted in a course of lectures on the Theory of Probability and mathematical statistics, delivered by V. I. Romanovsky. In the fall of 1935 the members of this Seminar will carry on research and practical work in such industrial undertakings of Tashkent as the Textile Combine, Agricultural Implements Industries, etc. A research statistical laboratory is to be organized this fall in Tashkent and will be connected with the Committee on Science of the Uzbek Republic. The aim of the laboratory is the development of mathematical statistics and their utilization in the fields of industry and agriculture.

V. ROMANOVSKY

Tashkend, U. S. S. R.

## THE INSTITUTE OF MATHEMATICAL STATISTICS

The organization meeting of the Institute of Mathematical Statistics was held on September 12, 1935, at Ann Arbor, Michigan. After the adoption of a constitution and by-laws, the following officers were elected: President, H. L. Rietz; Vice-President, W. A. Shewhart; Secretary-Treasurer, A. T. Craig.

Membership in the Institute will consist of Members, Fellows, Honorary Members, and Sustaining Members. A membership committee, consisting of Professors B. H. Camp, Harold Hotelling and A. R. Crathorne, will establish qualifications requisite for the different grades of membership.

The *Annals of Mathematical Statistics* was made the official journal of the new organization.

After the organization meeting, the following joint program with the American Mathematical Society was given:

1. The sampling theory of systems of variances, covariances and intra-class covariances, by Dr. S. S. Wilks, Princeton University.

2. Note on a certain bilinear form that occurs in statistics, by Professor A. T. Craig, University of Iowa.
3. On the frequency distributions of certain ratios, by Professor H. L. Rietz, University of Iowa.
4. Sheppard's corrections for a discrete variate, by Professor C. C. Craig, University of Michigan.
5. Factorial moments, by Mr. A. G. Swanson, University of Michigan.
6. Relations between two sets of variates, by Professor Harold Hotelling, Columbia University.
7. The probability that the standard deviation of a second sample will differ from the standard deviation of a first sample by less than a certain multiple of the standard deviation of the first sample, by Professor G. A. Baker, Mississippi College for Women.
8. The probability that the mean of a second sample will differ from the mean of a first sample by less than a certain multiple of the standard deviation of the first sample, by Professor Baker.
9. A postulational treatment of the Poisson law, by Professor A. H. Copeland, University of Michigan, and Professor Francis Regan, St. Louis University.
10. A new exposition and chart for the Pearson system of frequency curves, by Professor C. C. Craig.

## PROGRESS OF WORK IN THE CENSUS BUREAU

### An Advisory Committee on Vital Statistics

A special advisory committee for the division of Vital Statistics has been organized comprising the following members appointed by the Director of the Census: Lowell J. Reed, Johns Hopkins University, Chairman; Robert E. Chaddock, Columbia University; Louis I. Dublin, Metropolitan Life Insurance Company; Haven Emerson, Columbia University; Stewart G. Thompson, Department of Health, Florida; R. C. Williams, U. S. Public Health Service, Washington.

The Committee at a meeting held in Washington September 20 and 21 gave consideration to various matters brought to its attention by the Chief Statistician of the Vital Statistics division. These matters include the coding of the joint causes of death as returned on the death certificates, the scope and form of tables in the annual Mortality report, the issuance to libraries of sets of rota-printed tables containing detail not shown in the annual report, improvement in the completeness and accuracy of the registration, and other features of the vital statistics work. Sub-committees were appointed to make a further study of some of these questions.

### Estimating Population

The project for a quinquennial census of population and unemployment

was not approved; and it looks now as if there would be no population census before 1940. The Bureau therefore finds itself confronting the problem of supplying population estimates to serve as a basis for the computation of birth, death, and other rates or per capitas and other purposes. This is an especially difficult problem under the existing conditions following the period of depression in which there have been unusual population shifts. It is generally recognized that the traditional method of estimating by projecting the increase shown by the last census is inapplicable to the present situation. Even in normal times this method, although fairly satisfactory for the first three or four years following a census, is very unreliable in the later years of the decade.

The policy to be followed in regard to making estimates was the subject of a conference which was held in Washington September 21 in which the Special Advisory Committee on Vital Statistics, representative members of the Population Association, and officials of the Census Bureau participated. The conclusions arrived at, as formulated in a set of recommendations drafted by the Advisory Committee and adopted by the conference, were that the Bureau of the Census should continue to accept the responsibility of making population estimates; that it should use as a basis its own records, the records of any special censuses that may be taken, those of the education system, and such other records as might be found useful; that it should make estimates for individual cities having 10,000 inhabitants or more in 1930, also, so far as available information will permit, estimates for counties or groups of counties, and likewise for cities of from 2,500 to 10,000 as a group in each state, and for the total rural population in each state; that the method of estimating should be determined by the Bureau, and that in publication the method should be described and the reliability to be expected from the estimates be indicated; and, lastly, that the Bureau should be provided with adequate facilities for making short-term population estimates.

### A Card Index of Population Data

In the September issue of the Journal attention was called to the increasing use of the population census records for supplying personal data required for different purposes—particularly in connection with the increasing demand for certificates of age required in applications for old age pensions. The population schedules have been bound and arranged on shelves. But the arrangement is geographical, by states, counties and enumeration districts; and the names on the schedules are not in alphabetical order but appear in the order of the enumerator's visits. So before the records for any individual can be looked up it is necessary to know quite definitely where that individual was living when the census was taken; and even after the place of residence is given, searches, often very extended, have to be made before the name is found. The cost of this work is a considerable item in the Bureau's budget and is rapidly increasing. Moreover the schedules are being injured or worn out through this constant use.

It is, therefore, a source of great satisfaction to be able to announce that, thanks to the Federal Works Progress Administration, a card index of the 1900 population schedules is being prepared. The work is being done in St. Louis so as to give employment to people on the relief rolls in that city. The cards, which within each county will be arranged alphabetically by the name of the head of the family, will not only give the volume, page, and line where the entries will be found, but will have transcribed on them the name, month and year of birth, age, birthplace, and citizenship of each member of the family and the relationship of each to the head of the family. As this list comprises the items for which there is the greatest demand it will largely do away with the necessity of referring to the schedules. But until we have similar card indexes for other censuses it will still be necessary to search the original schedules for any information concerning persons born since 1900 or dying before that year.

### Financial Statistics of State and City Governments

On account of the reduction in the Census Bureau's appropriation for 1933 under the necessity for economy, the compilation of the financial statistics of state governments, it may be recalled, was suspended and at the same time the corresponding compilation for cities, which had regularly covered all cities of over 30,000, was limited to those of over 100,000. Consequently no state reports have been compiled for 1932 and 1933; and the city reports for those years cover only cities of over 100,000.

The 1932 city report was issued about a year ago. A summary report for 1933 has recently been published, and the complete report will be out by the time this issue of the Journal is in print.

The Bureau hopes to resume for the year 1936 the collection of statistics for states and to extend the scope of the city reports to cover again all cities of over 30,000. But for the reports of 1934 and 1935 the present limitations will be continued.

### Another Census of Business

The project for taking a census of business, mentioned in the June issue of the Journal, has been approved, being sponsored by the Works Progress Administration and financed from funds supplied by the Relief Administration Act. It will be more comprehensive than the census of American Business which was taken for the year 1933 or the census of Distribution which was included in the decennial census of 1930; since, in addition to wholesale and retail distribution and the service establishments covered by the previous censuses, this census will include construction, real estate business, banking, finance, insurance, transportation, and communication, the idea being to cover all lines of business which are not already adequately covered by existing statistical compilations. The basic statistical items are the same as in the previous censuses, comprising number of establishments, number of employees, sales or earnings, costs, and stocks on hand.

The headquarters are located in Philadelphia and the work of organizing and directing the census and assembling and tabulating the results will be done there. Outside the supervisory and technical force the employees for both field and office work will be taken from the relief rolls. The canvass will start January 2.

J. A. H.

## THE CENTRAL STATISTICAL BOARD

The Central Statistical Board was established by Executive Order No. 6225 in July, 1933, under the authority of Titles I and II of the National Industrial Recovery Act. The Board was instructed "to formulate standards for and to effect the coordination of the statistical services of the Federal Government incident to the purposes of the National Industrial Recovery Act." The Board was also authorized "to appraise and advise upon all schedules of all Government agencies engaged in the primary collection of statistics required in carrying out the purposes of that Act, to review plans for tabulation and classification of such statistics, and to promote the . . . improvement of the statistical services involved."

Executive Order No. 6700, on May 4, 1934, expanded the Board's authority to non-Federal agencies, defined further functions of the Board and conferred upon it mandatory power to "plan and promote economy and the elimination of unnecessary duplication." On June 15, 1935, Executive Order No. 7076 continued in effect the Executive Orders issued under the Recovery Act. An act to establish a Central Statistical Committee and a Central Statistical Board for a period of five years was signed by the President on July 25, 1935. A copy of the Act, as approved, is as follows:

[PUBLIC—NO. 219—74TH CONGRESS]

[H. R. 7590]

AN ACT

**To create a Central Statistical Committee and a Central Statistical Board, and for other purposes.**

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That there are hereby established a Central Statistical Committee (hereinafter referred to as the "Committee") and a Central Statistical Board (hereinafter referred to as the "Board") to plan and promote the improvement, development, and coordination of, and the elimination of duplication in, statistical services carried on by or subject to the supervision of the Federal Government, and, so far as may be practicable, of other statistical services in the United States.

SEC. 2. The Committee shall consist of the Secretary of the Treasury, the Secretary of Agriculture, the Secretary of Commerce, and the Secretary of Labor.

SEC. 3. The Board shall consist of a chairman, who shall be appointed by the President, with the advice and consent of the Senate, and not to exceed thirteen additional members, who shall be selected in such manner as the President shall prescribe: *Provided,* That not less than ten of such members shall be persons already in the service of the United States. The chairman and all the members shall be persons technically trained in statistics, economics, or public administration, known in their profession as of high standing and wide experience. The chairman shall be the chief executive officer of the Board, shall receive a salary of $10,000 a year, and shall not engage in any private business, vocation, or employment: *Provided, however,* That if the chairman shall at the same time hold any other paid position in the service of the United States, he shall receive during such tenure no additional remuneration for acting as chairman of the Board. No other member of the Board shall receive compensation for his services as such member, except that the Board may provide that any such other member not at the same time holding any other paid position in the service of the United States shall, while attending or traveling to or from meetings of the Board or of Committees thereof, receive a salary of not more than $25 per diem, and in addition thereto necessary traveling and subsistence expenses.

SEC. 4. The Board shall have authority to appoint such employees as it deems necessary for its own functions. All such employees shall be subject to the civil-service laws and the Classification Act of 1923, as amended, except that the Board may, with the consent of the Civil Service Commission, appoint and fix the compensation of any person or persons for temporary periods without regard to the civil-service laws and the Classification Act of 1923, as amended: *Provided,* That no person shall hold such temporary appointment or appointments for an aggregate period of more than 12 months. The Board may make such expenditures (including expenditures for personal services and rent at the seat of Government and elsewhere; for law books and books of reference; and for paper, printing, and binding) as may be necessary to carry out the provisions of this Act and as may be provided for by the Congress from time to time. The Board may purchase supplies or services where the aggregate amount involved is not more than $50, without regard to the provisions of section 3709 of the Revised Statutes, as amended (36 Stat. 861; U. S. C., title 41, sec. 5). There is hereby authorized to be appropriated, out of any money in the Treasury not otherwise appropriated, annually such sums as may be necessary for the expenses of the Board not to exceed $180,000, of which amount not to exceed $170,000 may be expended for personal services in the District of Columbia.

SEC. 5. The Board shall—

(a) At the request of the President or the Committee, or may of its own motion, investigate and make recommendations with respect to any existing or proposed statistical work carried on by an agency of, or subject to the supervision of, the Federal Government;

(b) Have the power, with the consent of the agency concerned, to investi-

gate and make recommendations with respect to any existing or proposed statistical work carried on by any agency in the United States other than the agencies specified in subsection (a) of this section;

(c) Have the power, subject to such rules and regulations as the President or the Committee may prescribe, to require from any agency specified in subsection (a) of this section information, papers, reports, and original records concerning any existing or proposed statistical work carried on by or subject to the supervision of any such agency: *Provided,* That this subsection shall not be construed to require or to make lawful any disclosure of confidential information when such disclosure is specifically prohibited by law;

(d) Plan and promote the economical operation of agencies engaged in statistical work and the elimination of unnecessary work both on the part of such agencies and on the part of persons called on by such agencies to furnish information;

(e) Perform such other duties consistent with section 1 of this Act as the President or the Committee may authorize, and make such reports to the Committee as the Committee may require; and

(f) Make an annual report to the Committee and to the President for transmittal to Congress.

SEC. 6. The Central Statistical Board created by Executive Order Numbered 6225, dated July 27, 1933, as amended, shall cease to exist at such time as the Committee shall declare that seven members have qualified for membership in the Board; and thereafter all records, papers, property, and funds of the old Board shall become records, papers, property, and funds of the Board; and such employees as shall pass tests of fitness prescribed by the Civil Service Commission shall acquire classified civil-service status and shall be employees of the Board at the grades and salaries specified in their respective examinations: *Provided,* That this section shall not be construed to impair any obligation incurred by the old Board.

SEC. 7. The Board with the approval of the Committee is authorized to prescribe rules and regulations to carry out the provisions of this Act.

SEC. 8. If any provision of this Act, or the application thereof to any person or circumstance, is held invalid, the remainder of the Act, and the application of such provisions to other persons or circumstances, shall not be affected thereby.

SEC. 9. This Act shall cease to be in effect and the agencies established hereunder shall cease to exist at the expiration of five years after the date of enactment of this Act.

Approved, July 25, 1935.

Pending the passage of an appropriation act to replace the lost third deficiency bill of 1935, the Board continues to operate under the Executive Orders mentioned above.

## A TREND LINE FOR GROWTH SERIES

The Research Section of the Federal Reserve Bank of New York has been testing a new trend line for growth series. There is a frequent need for a curve which shows a steadily declining percentage rate of increase. This behavior can be found in portions of parabolic curves but the behavior over the whole range of such curves is apt not to be rational. A parabola, for instance, may show a tapering off in the rate of increase but later take a sharp dive downward. Curves such as the Gompertz, the Pearl-Reed, and some other logistics, in which the time variable enters the exponent of a constant, possess the desired characteristics but their use has been retarded by apparent greater difficulty of application and lesser general familiarity with them.

The problem is to have $y$ increase at steadily decreasing rates as $x$ increases. Now if a number less than one is taken to successively higher roots, the number approaches one (i.e., rises) but by diminishing percentage increments. Making $x$, therefore, the root to which a constant $c$ is taken, where $c$ is a number less than one, the rise of $x$ values will create a movement in the same direction, but at a constantly diminishing rate, in the dependent variable. Thus $y = c^{1/x}$. A second constant, $b$, establishes the level of the curve, and at the same time constitutes an asymptote. A third value is introduced to obtain the flexibility of a three-constant curve and to make the curve independent of the point chosen as the time origin at which $x$ is 0. The equation then becomes:

$$y = bc^{1/(d+x)}$$

Stating the equation in the form

$$d \log y + x \log y - x \log b - g = 0 \qquad (g = d \log b + \log c)$$

and fitting the curve to the averages of the first third, second third, and third third of the data, one can easily derive the constants $b$, $c$, and $d$ by solving three simultaneous equations with three unknowns. If the middle year of the first third of the data is made the $x$ origin ($x = 0$) the work is made even simpler. (In general the geometric mean is preferable to the arithmetic mean. It is not necessary that the data be divisible or divided into three *equal* parts. The three averages should of course have as broad a base as possible and the average should be made to refer to the center year of each period.)

This trend line can be handled with a great saving of labor and at the same time it possesses the qualities of increasing at a diminishing rate and of not turning down.

NORRIS O. JOHNSON

## NOTES ON COAL CONSUMPTION

In its monthly letter for October 1935, the National City Bank supplies a record of the average fuel consumption of the utilities in terms of coal or equivalent per kilowatt hour for various dates from 1876 to 1934, as follows:

| Use of Fuel by Utilities—Equivalent Fuel per KWH. | |
|---|---|
| 1876 | 12 lbs. |
| 1890 | 8 |
| 1900 | 5 |
| 1910 | 4 |
| 1920 | 3 |
| 1925 | 2.1 |
| 1930 | 1.62 |
| 1934 | 1.45 |

The specially interesting point in this record is that the statistically uniform trend from 1876 to 1920 was apparently broken by the high prices of coal during the war and immediate post-war years, with the result of expediting the previously normal trend of increase in the efficiency of electrical generating stations to such extent that the 1934 figure is that which otherwise might have been attained in 1960.

An unexpected repercussion from this rapid increase in the efficiency of steam generation has been the economic (not technical) obsolescence of a large fraction of the hydro-electric plants in the Eastern United States.

A somewhat similar result is apparent in timber products, as to which increased lumber prices are developing the use of substitute materials to a point where reforestation seems to be largely a matter of provision for recreation parks, water protection, etc., rather than of lumber supply.

This special field for studies in economic statistics deserves, perhaps, more attention than it has yet received.

M. C. Rorty

Lusby, Calvert County, Maryland.

## LETTERS TO THE EDITOR

*The Editor, Journal of the American Statistical Association.*

*Dear Sir:*

In your issue of September, 1934, Mr. Norman Leon Gold, in his article on "Net Emigration from the United States to Canada: 1909–1931," states that "no careful estimate" has been made of the return movement of Americans from Canada, and adds in a footnote on p. 283:

> Mr. Roland Wilson prepared an estimate of the net movement to Canada from all countries for the period 1868 to 1925 (*Canadian Historical Review*, vol. xiii,

No. 2, June, 1932, pp. 157–183). For the most part, his study is based on computations from the decennial censuses. In the writer's opinion, many serious errors are present in that study. Though Mr. Wilson used sources similar to those in the present paper, the details of manipulation and the final results are quite different.

Several comments seem called for:

1. Mr. Gold has submitted a note to the Editor of the *Canadian Historical Review* describing the "serious errors" present in my article. If published, it will be accompanied by my reply, and some observations on Mr. Gold's attempted "corrections". Those interested may refer to the correspondence.

2. It is true that I used sources "similar" to those used by Mr. Gold, but I regard it as a matter for congratulation that "the details of manipulation and the final results are quite different". I hasten to explain myself.

So far as the figures for immigration into Canada are concerned, we seem to be in agreement, making allowance for the fact that my figures were stated for the Canadian financial years as usually published, while Mr. Gold's have been recomputed to years ending 30th June. My total for the period March, 1908, to March, 1925, is 1,116,860, and Mr. Gold's total for the period June, 1908, to June, 1925, is 1,105,770.

So far as emigration from Canada is concerned, no agreement was to be expected, nor is it in fact present. My estimates purported to represent approximately the emigration from Canada to all countries of *natives* of the United States. Mr. Gold's purport to represent emigration from Canada to the United States of *"Americans"*, i.e., not merely natives, or citizens, but anyone returning to the United States after living in Canada. (see his footnote 1, p. 282).

Mr. Gold presents estimates of the net migration of "Americans". Naturally my article did not.

If the matter ended here there would be little justification for burdening your space. It would appear, however, that Mr. Gold's estimates of the volume of returning Americans are themselves so seriously in error as to invalidate his whole article.

The trouble starts in the second column of Table I, "Return Movement of United States Citizens", on which the whole structure rests. Mr. Gold states on p. 283 that: "The most serious error in these figures, as a record of the return movement from Canada, lies in the fact that many persons enumerated arrived from over-sea residences, and merely entered the United States through Canadian stations". He made no attempt to correct this error, though to get the figures from his quoted source (Table I of the annual *Reports of the United States Commissioner General of Immigration*) he had actually to add together United States citizens returning *via* Canadian border districts, *via* Canadian Atlantic ports, and *via* Canadian Pacific ports. Surely it is a reasonable assumption that certainly the bulk, and most probably the whole, of those returning citizens, described by the Immigration Commission as entering the United States *via* Canadian ocean ports, were returning from over-sea countries and not from Canada. It is an assumption which I am

not able to verify immediately by direct inquiry at this distance, but it is supported by the fact that the Canadian border districts include *inter alia* the Montreal district and the Seattle district. In the case of United States citizens returning after having settled in Canada, even if they travelled *through* Montreal or Vancouver, for example, is it reasonable to suppose that they would be classed as returning *via* Canadian ocean ports rather than *via* the Montreal district or the Seattle district? Further supporting evidence is found in the *Report of the Commissioner General of Immigration* for 1930, p. 13. In 1930 and subsequent years the total only for immigrants and citizens returning from or *via* Canada is stated. Explaining the change, the Commissioner reports: "The increase in the recorded admissions . . . during the past year was due mainly to the inclusion of arrivals *from over-seas* who landed at Canadian seaports. This class has been heretofore shown separately . . . ". (Italics mine). Reference may also be made to a passage in the *Report of the Commissioner General of Immigration* for 1910, p. 140 (quoted in Viner, *Canada's Balance of International Indebtedness*, p. 50, note 1) which would appear to put the matter beyond all doubt.

The differences between the figures used by Mr. Gold and those representing the influx through the border districts are illustrated in the following table:

| Years ended 30th June | United States Citizens returned from Canada via border districts [1] | United States Citizens returned from Canada via border districts and ocean ports [2] |
|---|---|---|
| 1909 | ..... | 15,000 |
| 1910 | 22,832 | 28,831 |
| 1911 | 31,432 | 39,955 |
| 1912 | 38,317 | 45,051 |
| 1913 | 54,497 | 60,368 |
| 1914 | 44,013 | 50,482 |
| 1915 | 46,387 | 56,640 |
| 1916 | 32,440 | 33,709 |
| 1917 | 43,661 | 46,631 |
| 1918 | 27,733 | 29,096 |
| 1919 | 22,933 | 25,810 |
| 1920 | 15,607 | 19,712 |
| 1921 | 15,401 | 22,210 |
| 1922 | 13,384 | 20,999 |
| 1923 | 18,724 | 30,133 |
| 1924 | 13,673 | 23,219 |
| 1925 | 34,220 | 45,264 |
| 1926 | 10,625 | 20,969 |
| 1927 | 9,176 | 21,102 |
| 1928 | 7,063 | 22,543 |
| 1929 | 6,907 | 22,182 |
| 1930 | [3] | 9,134 |
| 1931 | [3] | 19,478 |
| 1910–1929 | 509,025 | 664,906 |

[1] The figures for 1928 and 1929 have been taken directly from the annual *Report of the Commissioner General of Immigration*, Table I. (Earlier reports are not available in Canberra). For the years 1914 to 1927 they were supplied by the Commissioner General by correspondence some years ago. For the years 1910 to 1913 they have been taken from J. Viner, *op. cit.*, p. 49.

[2] From Mr. Gold's Table I (column 2).

[3] No longer stated separately, as see text above.

On page 287 Mr. Gold remarks:

> In spite of the large amount of conjecture involved in the calculation, the results seem fairly reliable. They may be checked roughly by the census records of the increase or decrease in the United States-born residents in Canada.

His check consists in comparing the changes in the United States-born population of Canada between successive census dates with his estimated net migration of United States citizens between the two countries, with the implication that the two ought roughly to agree. In fact his two sets of figures are not worlds apart, but unfortunately the "check" calculation is wrong in principle, and in the same direction as the "checked" calculation. The two ought *not* to agree (even if we ignore the discrepancy between natives and citizens). The increase in the United States-born population of Canada between 1911 and 1921 was 70,344. Net emigration of natives of the United States to Canada must therefore have been equal to this figure *plus* the number of deaths of United States natives in Canada in the ten years. In 1911 the United States-born population was 303,680, and in 1921 it was 374,024. The number of such deaths must therefore have been of the order of 50,000, a figure more than sufficient to demonstrate the incompatibility of Mr. Gold's original estimates with the census data.

Sincerely yours,
ROLAND WILSON

Canberra, F. C. T., Australia

*The Editor, Journal of the American Statistical Association*

*Dear Sir:*

It is about two years since I wrote to Mr. Roland Wilson, through the Editor of the Canadian Historical Review, to question certain data and methods in his study that did not seem to me to be correct. Those remarks were written at the time I was working on net migration to Canada. Though I do not now have a copy of them, they were the basis for my footnote comment on Mr. Wilson's work to which he has taken exception.

The latter part of Mr. Wilson's letter is alone relevant to my paper. I, of course, do not disagree that there is an error involved in including some persons who were not previously residents of Canada as part of the return movement of United States citizens from that country. As Mr. Wilson pointed out, I criticized the data for that reason. The objection to my rough check is merely a phase of this error. By Mr. Wilson's table, some 77 per cent of the data used are adequate for the purpose I intended them. It is probable that further refinement of those data would make the record of the yearly movement and approximate net change through migration, which I had attempted earlier, more precise.

Yours very truly,
NORMAN LEON GOLD

Washington, D. C.

## SUGGESTIONS INVITED FOR AN IMPROVED STATISTICAL SLIDE RULE

The special statistical slide rule, announced a year ago,[1] has elicited favorable criticism from many sources. University professors and research directors have made inquiry regarding this rule and some have offered valuable suggestions. Several have expressed a preference for a twenty-inch instrument; one insists that the ordinates of the normal curve be included, along with the areas; a number have written the Keuffel and Esser Company, asking when the new slide rule would be on the market.

Manufacture of the slide rule has not yet begun, and since there is still an opportunity to improve it, its designer is anxious to receive suggestions and criticisms from readers of this Journal. They should be addressed to Dr. E. R. Enlow, Director of Statistics and Special Services, Atlanta Public Schools, City Hall, Atlanta, Ga.

The present design of the slide rule includes seventeen scales. On the obverse face will appear the eight scales of the log-log rule, namely: K, DF, CF, CIF, CI, C, D, and L. The reverse face will include scales for r, A, B, $a/2$, $x/\sigma$, Age $_2$, Age $_1$, $1-r^2$, and $\sqrt{(1-r^2)}$. The third, fourth, fifth, and sixth scales named are on the slide. The r scale is the old LLO scale, ranging from .05 to .97. The $a/2$ scale gives the area under a unit normal curve between the ordinate at the mean and the ordinate at the corresponding point on the $x/\sigma$ scale. The Age $_1$ and Age $_2$ scales are the old C and D scales divided into twelfths or sixths. Complete cuts of both faces of the new rule are shown in the original abstract.[2]

## CORRECTION

By a clerical error in the preparation of the Association's Handbook, Mr. Stephen M. DuBrul was listed as a member of the Finance Committee of the General Motors Corporation. Mr. DuBrul is a member of the Staff of the Chairman of the Finance Committee.

[1] "A Statistical Slide Rule," JOURNAL OF THE AMERICAN STATISTICAL ASSOCIATION, September, 1934, p. 318.

[2] Enlow, E. R. Abstract of "A Statistical Slide Rule." *Peabody Journal of Education*, July, 1934.

## CHAPTER ACTIVITIES

THE PITTSBURGH CHAPTER.—The July meeting was an open forum discussion of "Where Can Dependable Information be Obtained?" Messrs. Theodore A. Veenstra, Bureau of Business Research, University of Pittsburgh; Robert A. Burrows, Statistician, A. E. Masten and Company; J. Blair Easter, Investment Research Analyst with John A. Beattie and Company, led the discussion on the following subjects respectively: "Business Trends," "Industrial Analysis," and "Investment Decisions." The discussion disclosed many sources of varied information.

The August meeting was addressed by Mr. Wm. R. Hamilton, Superintendent of System Operation, West Penn Power Company. The subject was "Possible Use of the Dow Theory in Forecasting Business." The assistance of elements of the "Dow Theory" for forecasting electrical load was interestingly explained.

Mr. E. C. Stone, Assistant to the President, Philadelphia Company, spoke of the "Clouds of Uncertainty" at the September meeting. Mr. Stone recalled that in July, 1933, he had hazarded a prediction to the Chapter that during the following six months business activity would fluctuate within a range of 15 per cent plus or minus around the average level of the previous May and June. At that time business was approaching the climax of the New Deal boom and the forecast appeared unduly pessimistic to many of his listeners, but in July the Annalist Business Index reached a high point 14.6 per cent above the May-June average and in November a low point 12.2 per cent below that average. In July, 1935, in the face of what appeared to him to be an undue spirit of optimism, Mr. Stone made a careful study of the situation and concluded that during the remainder of 1935, business activity should remain "well within the boundaries established during the past twelve months," with an average level somewhat above that of the same period in 1934. He concluded further that the longer range outlook was not especially favorable and that, unless new forces not now apparent should enter into the business picture, business activity for the twelve months ending June, 1936, would not average much, if any, higher than it did for the preceding twelve months. This view was being supported by subsequent developments and by the more conservative character of recent predictions.

Mr. Stone pointed out that in many respects the present situation was comparable to that of the summer of 1933, except that at that time the wave of optimism was founded on expectations of the New Deal, while the recent optimism seems to be founded on hopes for its termination. Then, as now, industrial activity was to a considerable extent the result of building up stocks of manufactured goods. The creation of new fixed capital was almost at a standstill, reflecting lack of confidence in the future course of business. Other factors of uncertainty are the relatively high level of labor cost, the failure to reduce unemployment, and the threat of strikes. Profit margins have been narrowed to the place where enterprise has gained little or nothing

with increasing volume of business with the result that business men do not dare to launch out on the new undertakings that are essential to prosperity. The opportunity to refund outstanding indebtedness at lower interest rates has helped established businesses, but it does not stimulate new undertakings. The rapid increase in demand deposits, reflecting an increase in reserves due primarily to gold imports, to an increase in investments, chiefly obligations of the Federal Government, and to the continuance in some measure of hoarding, emphasize the extent to which present conditions are artificial and dependent upon the continuing extension of the Federal credit.

Mr. Stone analyzed the possibility of two types of inflation. The peace-time type which comes about from excessive capital development and speculative activity and is financed by bank credit and the war-time type which is brought about by war or other political crisis and is financed by the credit of the Federal Government. He concluded that the present indications do not warrant the expectation of inflation of a dangerous character, but suggested that two danger signals were diversion of funds from business to speculation and a decline in the market price of the outstanding obligations of the Federal Government.

Taking an overall view of the present situation, he found it hung with many clouds of uncertainty, traceable to Federal legislation of the past two years and to the policies of the Federal Government. The net result is that those who have funds to place in profitable investments lack confidence and business fears to embark on new enterprises. Hence, new capital development is practically at a standstill and industry proceeds with uncertainty on a hand to mouth basis.

THE SAN FRANCISCO CHAPTER.—Professor Neil H. Borden, Assistant Dean and Professor of Advertising in the Harvard Graduate School of Business Administration, presented to the Chapter on August 29, 1935, "A Case Study of Methods for Investigating the Effectiveness of Advertising." Using the advertising of the California Walnut Growers Association as an example, Professor Borden analyzed the difficulties which arise in any attempt to determine the effectiveness of an advertising program and discussed a number of approaches that may be employed. The Walnut Growers Association seeks to dispose of its crop each year for as good a price as it can without entailing a carry-over which would have an adverse effect on the price of the next year's crop. The officials of the Association have to determine each October the price that will be asked and the amount of money that will be spent on advertising and promotion to aid in disposing of the crop. They therefore presented the following questions: "Should we use advertising, and if so, to what degree?" "Does advertising aid sufficiently in increasing sales to justify the expenditure?" "Was the money that has been expended on advertising employed in the most effective way?"

The advertising of the Association had been indirect, that is, it sought to instruct housewives in the uses of walnuts but did not make a drive for immediate action on the part of the readers. Consequently it was impossible

to trace the response to each advertisement and exceedingly difficult to measure the over-all effect of the advertising program. Sales statistics were analyzed to see whether they revealed an increase in consumption or in prices that might be attributed to advertising. The analysis included statistics for other nuts and a breakdown of sales and advertising data by territories. Even though several variables which affect sales volume were controlled, the analysis failed to give any conclusive evidence with regard to advertising effectiveness. Many factors affect sales volume, they are constantly changing, and some of them do not lend themselves to statistical measurement. Consequently it was believed that a conclusion with regard to the advisability of the use of advertising and the amount of advertising would not rest on any statistical or mathematical demonstration, but would have to be merely a matter of judgment coming from such statistical evidence as was available, and an appraisal of the many immeasurable factors involved in the sales. The use of statistics alone, while it had been helpful, had not given any conclusive evidence with regard to the effect of advertising.

An appraisal of factors not so readily susceptible to statistical treatment led to several conclusions: advertising had been of value from the competitive brand standpoint, especially in maintaining a higher price for the Association's product; it appeared to have stimulated the selling activities of brokers and dealers; it may have helped also in maintaining per capita consumption against certain adverse trends such as changes in dietary habits. Advertising was also a factor in direct competition with other domestic nuts, particularly pecans, and in direct competition with other food products, many of which were being supported by heavily increasing advertising expenditures. All these immeasurable factors had to be weighed and when they had been considered it was concluded that the advertising expenditure made by the Association had been justified from the standpoint of business management. The conclusion, however, was not mathematical or statistical, but was an answer based upon business judgment.

The problem of determining the amount of advertising appropriation is likewise a matter of judgment and must be considered partly in the light of competition for attention from other advertisers as well as the strength of the appeal in increasing sales. Several techniques were employed to test the relative effectiveness of different types of advertisements and different media. Among these were an analysis of coupon inquiries, a study of effectiveness of advertisements as rated by a consumer reader reporting service, a consumer opinion study of various types of copy approaches in advertising, and an extensive field investigation to determine consumer attitudes and buying habits.

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## STATISTICAL NEWS AND NOTES

BOARD OF GOVERNORS OF THE FEDERAL RESERVE SYSTEM.—In the August *Federal Reserve Bulletin* were published figures for member bank excess reserves on a comparable basis with other Federal Reserve and member bank statistics. Data were given on a Wednesday and end-of-month basis from September 1931 and on a monthly average basis from January 1929. About the same time figures for excess reserves were also included in the weekly Federal Reserve bank statement, and current figures are now regularly given in the weekly statement and in the *Bulletin*. Regular publication of these data was inaugurated because it has come about that excess reserves of member banks reflect in their movements the net result of the various factors that influence the supply and use of member bank reserves and are at present, therefore, the most significant basic banking statistics.

In the July *Federal Reserve Bulletin* an article was published on the "Supply and Use of Member Bank Reserve Funds" describing in detail the figures used to measure, and the significance of, the various factors influencing the supply and use of reserve funds. This is the most comprehensive description of this analysis that has been published by the Board. Reprints of this article, together with all available statistics of the various factors on a weekly, a monthly, and an annual basis, have been prepared and may be obtained upon request from the Board's Division of Research and Statistics.

The weekly statement of condition of reporting member banks in leading cities, issued by the Board, was revised as of November 6. The revision was three-fold in character. In the first place, the number of cities covered by the statement was increased from 91, which had been shown since the banking holiday, to 101, the number covered by the report prior to the banking holiday. Secondly, the form of statement was revised to show a number of additional items. Statistics on this revised form have been collected since September 1934, but with the exception of a detailed classification of loans and investments, had not previously been published. Finally, the statistics of net demand deposits, which represent demand deposits subject to reserve requirements, have been discontinued and in their place figures are given for adjusted demand deposits. The figure for adjusted demand deposits excludes United States Government deposits, interbank balances and "float" and is computed for the purpose of providing a more significant measure of the country's available demand deposit balances rather than for showing deposits subject to reserve requirements. The change was made particularly desirable at this time by the fact that as a result of the Banking Act of 1935 the computation of net demand deposits was changed and the current figures are not comparable with those previously published. All series needed for the computation of adjusted demand deposits, moreover, were not available until the report form was revised in September 1934.

In connection with the revision of the weekly report form, an article was published in the November *Federal Reserve Bulletin* describing the various member bank statistics collected by the Board. Figures for the various items shown in the new report form for banks in the 101 cities since September 1934, together with such figures as are available for the 101 cities from January 1933 to September 1934, were also published in the November *Bulletin*. In the same issue of the *Bulletin* a new table was added giving statistics of reserves, borrowings, and deposits of all member banks at call dates. Similar data, together with classified figures of loans and investments, both for all member banks and for weekly reporting banks will be regularly published in subsequent issues of the *Bulletin*.

In cooperation with other interested agencies and organizations, the Division of Bank Operations has given consideration to the revision of the call report form of condition of member banks. The details of the new form have not yet been completed and reports on the new basis will not be inaugurated until sometime in 1936.

Since the latter part of 1934 the Division of Research and Statistics has been engaged in a detailed study of deposits, turnover, and reserves of member banks during the period from 1924 to date, for the purpose of determining the effect upon member bank reserve requirements of the proposals of the Federal Reserve System's Committee on Member Bank Reserves, published in 1931. The principal features of these proposals were that computation of reserve requirements be based upon debits to deposit accounts as well as upon the amount of deposit balances and also that within certain limits vault cash be counted as reserves. The present study is based upon special reports of deposits, debits, and cash holdings of a selected list of member banks from various regions classified according to principal economic activity.

The Division of Research and Statistics is engaged in a thorough revision of the Board's index of industrial production which was first published in 1927, and has undergone no major revision since that time. Work on this project to date has consisted principally of a study of available production statistics and of attempts to discover and, where necessary, to promote the collection of better statistics of production in various fields. Some study has also been made of the number of working days and changes in seasonal variation in different industries.

The Division of Security Loans has inaugurated the regular collection of end-of-month statements from members of registered security exchanges. These statements are given in the form of a balance sheet and include information as to customers', partners', and firms' debit and credit balances, as well as to borrowings, which have heretofore been the principal figures available regarding the use of credit in security trading. It is contemplated that when the reporting service has been firmly established the figures will be regularly made available for publication.

Other new information recently published in the *Federal Reserve Bulletin* includes: (1) Average yields on long-term United States Government bonds, 1919–1925—August *Bulletin;* (2) Deposits and assets of the Postal Savings System, 1911 to date—August *Bulletin* and subsequent issues; (3) Amount of obligations fully guaranteed by the United States outstanding at the end of each month since October 1933—August *Bulletin* and subsequent issues; (4) Industrial advances and commitments applied for at and made by Federal Reserve banks—September *Bulletin* and subsequent issues; (5) Number and loans of Federal savings and loan associations—August *Bulletin* and subsequent issues.

THE DIVISION OF RESEARCH AND STATISTICS OF THE TREASURY DEPARTMENT.—The Office of the Director of Research and Statistics and the Division of Research and Statistics in the Treasury Department were created by order of the Secretary dated September 17, 1934. By the terms of the Order, the Director of Research and Statistics exercises full responsibility for all economic research and statistical work performed in the several branches of the Treasury Department.

The new Division, which absorbed the Section of Financial and Economic Research, in the Office of the Secretary, has undertaken intensive research in fields of Treasury activities, embracing the four fields of taxation, financing, money and banking, and administrative statistics.

For several years a duty of the research staff in the Secretary's office has been the preparation of periodical estimates of tax receipts by major sources. More recently these estimates have been made for each individual tax with an increasingly greater refinement of detail. The estimates must be based upon quantitative studies of the underlying conditions of business activity with an eye to the probable near term course of business. For this purpose the Division obtains from other departments of the Government as well as from business publications hundreds of economic series which are surveyed and focused upon the problems of forecasting Federal revenues.

The Federal tax structure is of a dynamic character and the Division has undertaken a series of investigations to provide data needed for appraising proposed revisions of our tax structure. In this connection one of the most important research tasks is the analysis of the volume and distribution of the national income, as reported for tax purposes. Another problem of tabulation and analysis is involved in the study now being made of the character and degree of conflicting and overlapping taxation by Federal, State and local governments. The Director of Research and Statistics is a member of the Tax Revision Council and is chairman of the Research Committee engaged in studying this problem.

The Treasury has obtained an allotment from the Emergency Relief Fund with which to conduct a study of income tax returns, as a Federal "white

collar" project. The main regional office has been established in Baltimore, Maryland, and six other offices are to be opened soon.

The entire study is designed to supplement the "Statistics of Income" now published annually by the Treasury Department, and to provide information not heretofore made available. In the first category is the tabulation of the individual income tax returns for 1934. Special emphasis will be placed on returns showing net incomes under $5,000. In addition to providing the distribution of reported income in small class intervals and by counties and cities, the tabulation will provide a check on the sampling procedure now utilized to tabulate the "small" returns. A separate tabulation will be made of the returns showing capital transactions in order to determine the net effects of the new method of treating capital gains and losses introduced by the Revenue Act of 1934.

In the second category is the tabulation of partnership returns, fiduciary returns and business schedules appearing on the individual returns. The results will conform as far as possible with those obtained from the corporation returns.

Tentatively, it is also planned to carry out a special study showing changes in the distribution of income of identical individuals for the period 1920–1934 and a study of identical corporations for the same period with special emphasis on the allocation of corporate income, and changes in depreciation allowances.

The Division, through the preparation of appropriate memoranda, acts in an advisory capacity to the Secretary of the Treasury in problems relating to Treasury finance. In addition to making analyses of domestic conditions affecting Treasury financing, the Division makes an effort to apprise the Secretary of financing experience and innovations in other countries.

The position of the United States dollar both at home and abroad is the continuing concern of the Secretary of the Treasury. In this connection he has two important mandates (1) the operation of the Exchange Stabilization Fund and other provisions of the Gold Reserve Act of 1934 and (2) the silver purchase provisions of recent monetary legislation. The Division of Research and Statistics is charged with the responsibility of providing a broad range of materials and analyses to aid the Secretary in executing these mandates.

A large volume of statistical material and reports is received daily and weekly by the Division from domestic and foreign sources. At the instance of the Treasury, information, such as that relating to the position of short-term balances and banking and exchange portfolios, is now being collected by various agencies and is continuously tabulated, charted, and analyzed by the Division. The movements of foreign exchange rates are followed daily and even hourly and an attempt is made at all times to seek both the short-term and long-range factors influencing these movements.

Extensive administrative statistics are compiled by various units of the Treasury, notably the Bureau of Internal Revenue, the Bureau of Customs, and the Bureau of Narcotics. A program of coordination among the tabulators and interpreters of these statistics has been under way for several months.

The Government Actuary is a member of the Division of Research and Statistics and conducts the many actuarial studies necessitated by various phases of Treasury activities. He also supervises the calculations of yields on all Treasury obligations and serves as a member of the Board of Government Actuaries.

FEDERAL HOUSING ADMINISTRATION.—The statistical activities of the Federal Housing Administration during its first year of organization have been devoted to developing: (1) detailed analyses and reports of its own activities in the mortgage and modernization credit insurance fields, and (2) special tabulations and original techniques designed to increase the amount, the accuracy and the usability of housing and mortgage statistics. The following material is available at the present time.

1. *Statistics on Credit Insurance Activities.* A daily summary table records the total value of modernization and repair notes insured, and the total value of home mortgages selected for appraisal. In addition, special detailed analyses are issued at intervals, showing the classification of insured loans according to size and purpose, occupation and income of the borrowers, number of financial institutions operating under the Federal Housing Administration plan, and other facts bearing on credit insurance operations. Summary tabulations and charts of this material, together with other breakdowns of the available information, appear in the Annual Report which is issued early each year.

2. *Special Studies and Tabulations.* The Division of Economics and Statistics has cooperated with the Central Statistical Board, the Federal Emergency Relief Administration, the Federal Home Loan Bank Board, the Housing Division of the Public Works Administration, and other agencies concerned in developing a standard procedure for conducting comprehensive real property surveys. The technique has been evolved from the experience gained in the Real Property Inventory, the Financial Survey of Urban Housing, and a number of housing surveys conducted as local relief projects under the direction of the Federal Emergency Relief Administration. In addition, experimental schedules and instructions were prepared and tested in eleven communities in West Virginia and Pennsylvania under the direction of the Federal Housing Administration and with the cooperation of the Coordinator of Statistical Projects of the Federal Emergency Relief Administration.

This "Technique for a Real Property Survey" provides detailed instructions for each operation from the initiation of a project to the presentation

of its findings through maps and tables. A complete set of tables and forms, including those necessary for city summaries and for tabulations by city blocks, have been designed to permit a more thorough analysis of results than has been possible in previous surveys of this type. Instructions are included for the conduct of Land Use Surveys to provide data for land use and land coverage maps. The method of procedure specified in this work has been adopted as a standard for Works Progress Administration projects to be conducted this winter.

A retabulation of the original enumeration schedules of the Real Property Inventory covering 64 cities has been made to permit an analysis of the housing situation in terms of city block units. The retabulation was in summary form and did not include any cross-classification of items. Among the significant factors summarized for each block were: average rent, total number of residential structures, and percentages of residential structures under 15 years of age, of dwelling units owner-occupied, of residences needing major repairs, of units without private baths, of commercial buildings, and of race other than white. Maps have been prepared for each of the 64 cities, on which the above data have been entered in small figures for each block, and on which the block units are colored to represent the level of rent and property values. The maps thus permit a quick survey of the character of housing by blocks throughout each city, and provide block data necessary for detailed studies of neighborhoods.

Two studies bearing on the problems of the geographic distribution of the housing market have been completed by the statistical staff. One of these, the "United States Housing Market", indicates what share of the total market for housing may be expected in each state, county, community and metropolitan district in the United States. The method used is as follows:

A group of five factors were selected on the basis of predominant influence on the size and location of the housing market. These factors were: the population, the number of dwellings, the type of dwellings (value, tenure, etc.), the retail outlets, and the purchasing power. Statistics measuring the first four factors were obtained from the 1930 Census, and the fifth, the purchasing power, was measured by combining the total number of income tax returns, the number of residential telephones, and the number of automobile registrations into an index, rating each of the components equally.

One billion dollars is used as the base figure to represent the national housing market (Estimates of both the normal annual and the total accumulated housing requirements can be expressed as multiples of this base.)

In applying the five factors, each is considered of equal importance, and the quota is thus an average of the five factors used. State quotas are calculated as proportions of the $1,000,000,000 base for the United States, county quotas are calculated as a percentage of each state quota, metropolitan districts are compiled by adding constituent counties or fractions thereof, and urban and rural group quotas are also calculated.

By this method quotas are presented for 48 states, 96 metropolitan dis-

tricts, and 3,098 counties. The quotas indicate the distribution of the total United States housing market, when that term is defined as the sum total of all expenditures for shelter, including expenditures both for new houses, and for the improvement, furnishing and equipment of old ones. The quotas indicate housing demand as contrasted with housing needs.

A second study relating to the potential demand for housing has recently been completed, and will be published soon. The work concerns itself with the effect of extra families on the housing market. Basically, it is a recheck of the extra families reported in Martinsburg, West Virginia, by the Real Property Inventory in order to determine accurately that percentage of the extra family group which in more prosperous times would expect to occupy separate quarters. Tabulations are presented of the normal number of extra families, the number doubled up because of economic pressure, the length of time they have been living together, whether or not they desire to undouble, and the type of dwelling that would be required should they undouble. The economic ability of the family to undouble is estimated, and the number of rooms and persons, levels of rents, and property values and other pertinent data, are made available. A detailed account of the technique involved and a complete set of tables designed for comprehensive enumeration purposes are included.

A volume entitled "Analysis of Housing in Peoria" embodies the results of an extended analysis of Peoria, Illinois, statistics gathered from the Real Property Inventory, the Financial Survey of Urban Housing, and other sources. The study was undertaken in order to determine precisely the application of such material to the problems of the Administration, to select pertinent items and to determine in what form the data could best be prepared for analysis. The report is divided into four sections: Part one deals with the economic background of the community, and includes summarizations in table and chart form of the commercial and industrial activities, population growth and composition, and various indices indicating economic trends such as payrolls, postal receipts, taxable incomes, and marriage licenses. Part two considers the housing situation as a whole, and gives an interpretation of the material from the two surveys. Charts and tables include recordings of types of structures and their condition, occupancy and vacancy totals, average number of persons per dwelling unit and per room, and methods of acquisition. Part three analyzes the survey material on the basis of geographical units (single block and 10–20 block units). Part four is an attempt to analyze the relationship of various factors to value stability. This part contains discussions of such topics as the level of value as an influence on the stability of value, the condition of property and value stability, inharmonious land uses, rent, zoning, etc. An appendix of 192 tables completes the volume.

DIVISION OF RESEARCH AND STATISTICS, FEDERAL HOME LOAN BANK BOARD.—The Division publishes monthly in the *Home Loan Review* a breakdown of

the permit data which shows monthly permits classified on the following basis: one-family dwellings, two-family dwellings, joint home and business dwellings, and multi-family dwellings. A statement of the cost of all new residental building and the cost of all one and two-family dwellings tabulated by states and classified according to the Federal Home Loan Bank districts is also published. These data are all taken from the permit data gathered by the U. S. Bureau of Labor Statistics. The Bureau of Labor Statistics has in the past classified the permit data only by years. Through the cooperation of the Department of Labor the Division is securing this classification now by months and publishing it in the *Home Loan Review*.

The Division prepares monthly for the *Home Loan Review* a statement of the applications received and loans closed by months for the Home Owners' Loan Corporation. It also shows for the Reconditioning Division of the Home Owners' Loan Corporation the number of applications received for reconditioning loans, total contracts awarded, and total jobs completed.

The Division has been preparing for some time a monthly report on real estate foreclosures. This report is prepared in such a way as to show identical communities from 1932 to date and also for 1926 so that foreclosures during the depression may be compared with an approximate normal base as shown by 1926 data.

A weighted index showing the course of foreclosures in the United States and a weighted index on urban foreclosures are being prepared. These indexes will enable the Division to develop a broader coverage in foreclosure information. A tentative weighted index on foreclosures in the U. S. has already been prepared and will possibly be published at a later date.

The Division has in process a thorough analytical study of the capital structure of building and loan associations. The *Home Loan Review* of August, 1935, published an article based on this study, and there will probably be further studies of this kind.

The Division publishes each year an annual report of the Federal Home Loan Bank Board. The annual report of 1934 contains an extensive analysis of the operations of all the agencies operating under the Board, showing the financial operations of these agencies and their condition as of December 31, 1934.

At the present time there is in preparation an annual report showing the condition of member banks of the Federal Home Loan Bank System. The annual report heretofore has given thorough attention to the operating statements and balance sheets of the Federal Savings and Loan Associations but has not been in a position to report so thoroughly on the annual report of the non-federals. In the *Home Loan Review* of October, 1935, there will appear, however, a combined income and expense statement for one of the districts of the Home Loan Bank System. Such combined statements and also balance sheets will appear from time to time during the next three to six months.

The Division of Research and Statistics is also preparing to collect data

that will show a classification of new mortgage loans made each month by building and loan associations and mutual savings banks. At the present time data of this character are available from life insurance companies and from banks. This Division is in the course of development of comparable data from the two other types of agencies from which information is now unavailable.

The Division prepares, of course, a great deal of operating data which are of interest to the Corporation but not of particular public interest. Occasionally publication is made through the *Home Loan Review* of some reports arising in this way which seem to be of general public interest.

BUREAU OF FOREIGN AND DOMESTIC COMMERCE.—"Foreign Trade of the United States, 1934," has been published. The "Foreign Commerce Yearbook, 1935," covering 1934 data, is to be published early next year. The first volume of "Foreign Commerce and Navigation of the United States," calendar year, 1934, has been released and the second volume will probably be available this month. The revision of schedules A, classification of imports, and B, classification of exports, has been completed and will be released this month. "Where China Buys and Sells" and "Rubber Regulations and the Malayan Plantation Industry" were released in September. A study of "United States Share of India's Trade Since the World War" is being completed by the Division of Regional Information. It might be appropriate to remind interested members of the fact that the Finance Division publishes fortnightly, for a subscription mailing list, a series of Latin American, European and Far Eastern Financial Notes in which changes in exchange restrictions are kept up to date. Special circulars are occasionally prepared among which mention might be made of number 410 which gives the foreign exchange restrictions in European countries.

The first American Supplement to the publications of the Comité International du Bois was received in late August. "North-American Lumber Exports and World Total" gives timber exports in cubic meters for the first quarter of 1934 and 1935 for Canada, United States, Europe, and the world. The North-American figures are supplied through the cooperation of the Bureau's Divisions of Foreign Trade Statistics and Forest Products and of the Dominion Bureau of Statistics. The Committee plans to publish the American Supplement quarterly.

Estimates of the national income for the years 1929–34 inclusive appeared as a special article in the August *Survey of Current Business*. The complete study, including revisions of the data published in Senate Document No. 124, 73rd Congress, 2nd Session, "National Income, 1929–32," will be received from the Government Printing Office in a few weeks.

The "Statistical Abstract of the United States, 1935," fifty-seventh number, has been pushed for release this month.

Reports on "Consumer Use of Selected Goods and Services, by Income Classes" have been continuing. It is expected that by the first of the year

these will have covered one city in each of the nine census districts by the addition of Columbia, South Carolina, Salt Lake City, Utah, Trenton, New Jersey, San Diego, California, Racine, Wisconsin, Birmingham, Alabama, to those mentioned in the September JOURNAL.

The Marketing Research and Service Division has scheduled for release this month the study on "'For-Hire' Retail Parcel Delivery Service." The "Consumer Market Data Handbook" will probably be available this month. "Market Research Sources," 1935 edition, has gone to the printer and the revised "Atlas of Wholesale Grocery Trading Areas" will be available shortly.

The summaries of sales tax legislation by states have been revised. The most recent revision of the data was reproduced in a brief table in *Domestic Commerce*, September 30, 1935.

Three reports to be published this year-end will cover the construction, food and chemical industries and their leading trade associations. "A Review of the American Machinery Industries" will be available this month.

An estimate of the volume of 1935 retail sales will be made sometime in February 1936. In the retail trade field the Bureau has been increasing the coverage of its monthly sales releases. During recent months retail sales reports have been received from chain drug, men's wear and shoe companies.

With the cooperation of participating companies it is hoped that these reports can be maintained upon a permanent basis and that preliminary releases on monthly sales can be made by the twenty-fifth of each month for the previous month's sales. Monthly changes in the dollar volume of sales in independent retail stores by major kinds of business have been tabulated for Illinois, Indiana, Wisconsin, Texas, New Mexico, and Oklahoma. The Bureau plans to release each month figures showing percentage changes in retail sales in independent stores in each of these states and to extend this service to cover independent store sales in other states.

A project for the monthly reporting of sales and of accounts receivable data from some fifteen lines of wholesale and manufacturing trades is being worked out by the Bureau in cooperation with the National Association of Credit Men. It is hoped that the project will be sufficiently advanced early in 1936 to make possible the regular issuance of monthly releases.

NATIONAL RECOVERY ADMINISTRATION.—Although the decision of the Supreme Court invalidating the codes has necessarily curtailed the statistical activities of the National Recovery Administration, the Statistics Section has been continued intact in the Division of Review under William J. Maguire, formerly Assistant Chief of the Section. The accounting work of the Division is also being handled in this Section under Orton W. Boyd, Associate Chief of the Section.

The research program which the Division of Review has undertaken to complete by April 1, 1936, consists chiefly of industry, trade practice, labor, code administration, and NRA organization studies, and for most of these, statistical material is required. Members of the Statistics Section have been

assigned as statistical advisers to most of the study groups, and these persons determine through conferences with the groups the most important statistical material bearing upon the subjects being studied, the manner in which this material may best be used, and the validity of the conclusions based upon it. If it is proposed to obtain data through questionnaires, these must be cleared with the Statistics Section in order to justify this method of securing the data and to make sure that the questionnaires are statistically sound. A final task is that of reviewing the studies prepared in the various study sections to make certain that the statistical material incorporated has been properly used.

The Statistics Section also handles miscellaneous requests for statistical material emanating from within or without the NRA, and maintains a drafting room to give service to the various study units in the preparation of charts, maps, and similar material.

BUREAU OF MINES.—At the time this issue of the JOURNAL goes to press officials of the Bureau of Mines and of the Census of American Business, with the encouragement of the Central Statistical Board, are seeking to work out a method of cooperation whereby a joint canvass will be undertaken of the mining industry for 1935. It is felt that such cooperation would eliminate the sending of largely duplicate schedules to mineral producers, and at the same time enlist the extensive permanent field staff of the Bureau of Mines in the collection of information desired by the Bureau of the Census.

The Department of the Interior appropriation bill, approved on May 9, 1935, included a provision transferring the Minerals Division of the Bureau of Foreign and Domestic Commerce to the Economics and Statistics Branch of the Bureau of Mines. This move has strengthened the commodity divisions of the latter Bureau and permitted the inauguration of a series of special economic investigations that cut across the field of individual minerals. Work previously carried on by the Bureau of Foreign and Domestic Commerce with reference to world trade in minerals will be continued in the Bureau of Mines.

The *Minerals Yearbook 1935* is available from the Superintendent of Documents at a price of $2.00. Statisticians who desire copies should order them at once since the demand for this volume has always exceeded the supply.

GRAIN FUTURES ADMINISTRATION.—The statistical work of the Administration is concerned primarily with the collection, compilation, and critical analysis of grain futures volume of trading, open commitment, and price data. The clearing members of the grain exchanges that have been designated as contract markets under the Grain Futures Act file with the field offices of the Administration daily reports setting forth volume of trading and open commitments in grain futures and deliveries of grain under futures contracts. The Administration since January 1924 has made public daily the volume

of trading at the principal contract markets and since August 1928 has announced daily the open commitments of clearing members. Previously, owing to the lack of such information, hedgers and other traders had been compelled to grope about in the dark. The Administration issues a monthly release presenting grain futures volume of trading, open commitment, and price data with respect to the domestic markets and certain wheat, corn, and oat price data with respect to the principal foreign grain futures markets. Special reports are compiled from time to time for the information of Congress and the public predicated upon data compiled from clearing members' reports, supplemented by observation of exchange activities and by special surveys and investigations.

BUREAU OF AGRICULTURAL ECONOMICS.—Combined index numbers of prices paid by farmers for commodities, taxes payable per acre of farm real estate, and interest payable per acre on farm mortgage indebtedness were issued by the Bureau in a mimeographed release, August 1935. These index numbers were constructed from 1910 to date to conform to the specifications for computing parity prices of farm products—except those basic commodities having a post-war base—as specified in the 1935 amendments to the Agricultural Adjustment Act. The combined index number of prices, taxes, and interest payable by farmers for September 1935 is estimated at 128 per cent of the 1910 to 1914 average compared with 125 for the index number of prices paid by farmers alone. The latter constitutes 86 per cent of the combined index number, whereas interest payable has a weight of 7.2 per cent and taxes payable have a weight of 6.8 per cent.

Revised estimates of acreage, yield per acre, and production, 1866–1929, were released in August 1935, for potatoes and tobacco. These revisions were made as a joint project of the Divisions of Crop and Livestock Estimates, and Statistical and Historical Research of the Bureau of Agricultural Economics. Similar revisions have previously been released for wheat, corn, oats, hay, barley, and cotton.

BUREAU OF LABOR STATISTICS, U. S. DEPARTMENT OF LABOR.—The survey of employer-employee relationships, which the Bureau began last summer, is now nearing completion, and preliminary results have been published in article form in the *Monthly Labor Review*. The survey was in two parts: One part was based on questionnaires sent to some 43,000 establishments and dealt primarily with matters permitting of statistical presentation. The second part involved field study by members of the Bureau's staff covering 126 firms.

The Bureau is continuing its series of studies of the subject of the exact amount of labor time, expressed in man hours, created by particular types of industrial production for public works projects. The iron and steel industry and apartment-house building have already been covered. A similar study of the cement industry is now completed, and other industries are to

be covered in the same way. The results of these various studies are being published as articles in the *Monthly Labor Review.*

The customary annual survey of union wage scales, which had to be omitted in 1934 because of lack of funds, has been completed for 1935, and corresponding figures were secured at the same time for 1934. A report covering the building-trades division of the survey was published in the November 1935 issue of the *Monthly Labor Review,* and the complete report is in preparation. The last of three articles on wages, hours, and working conditions in the petroleum industry was published in the November 1935 *Monthly Labor Review.* Similar reports for the automobile, bakery, and tobacco industries are nearing completion. In the automobile industry a study of annual earnings is included. A special inquiry into the salaries and working time of municipal policemen and firemen has also been completed and the results given in recent issues of the *Monthly Labor Review.*

Pending completion of the family-budget inquiry of the Bureau, which will furnish up-to-date weights for calculating cost-of-living indexes, certain changes in the methods of computing the index have recently been introduced, one important change resulting from the inclusion, since January 1935, of a much larger number of food prices than formerly used. This revision was described in an article in the September 1935 *Monthly Labor Review.* It is planned also to revise the retail-price index to include a considerably larger number of commodities.

A revision of the Handbook of American Trade Unions, the last edition of which was published in 1929, is now under way. Also, a 1935 edition of the Handbook of Labor Statistics is in press.

UNITED STATES EMPLOYMENT SERVICE—*Inventory of Registered Job Seekers:* Field work preparatory to the setting up of comprehensive central records from which periodic detailed surveys of all job seekers registered in public employment offices is now being conducted in offices of the United States Employment Service throughout the country. Following completion of the field work on December 15th, files of individual punched card records will be established in six central offices which will have mechanical tabulating facilities allowing detailed studies of employment office files on a national scale. The punched card file, once established, will be maintained on a current basis by means of the regular statistical operations of the Employment Service.

The initial survey made available through this program will cover all job seekers registered for work on November fifteenth. The records of approximately nine million persons will be included in the study. Included in this number are the registrations of several million non-relief recipients who are seeking work. In addition nearly complete coverage of all relief employables will be secured, registration for employment having been required of relief employables under the Works Program.

The inventory records of these nine million employment seekers contain a series of items establishing the personal status of each applicant and his

place in the economic organization of the country. Information giving the principal occupation of each person, established on the basis of his training and experience as reported to the interviewers of the national employment office system, will be supplemented by reports of the industrial background of each applicant with work experience. Items relating directly to the personal classification of the registrants include age, sex and color. In addition the initial study will report relief and veterans status.

A by-product of this program has been the introduction of a uniform system of personal identification numbers which is being used in all employment offices affiliated with the Federal employment service. This numbering system indicates the state and county in which each applicant resides and assigns an individual serial number to every applicant within each county. Set up on a flexible basis in anticipation of the requirements of the social security program, the system has been accepted as a basis for identifying the individual records which will be required in unemployment insurance.

The United States Employment Service recently completed the formulation of a new system of occupational classification which will be used in the survey. The new classification, which was prepared after a comprehensive analysis of existing occupational classifications, is designed to afford groupings of occupations in a manner which will eliminate industrial stratification as far as possible and will serve as a basis for pointing out the degree of mobility of certain occupations across industrial lines. Eight major groups are established in the classification, each one composed of a homogeneous group of occupations. Additional subgrouping is provided within each major group. Approximately eleven thousand occupational titles will be found in the classification. A five-digit code system is used in identifying the material for tabulating.

Cancellation of the projected census of unemployment which had been planned under the Works Program leaves the Employment Service survey of active registrants as the most comprehensive study of the unemployed group in this country. The study is not designed as an attempt to determine total unemployment or as a substitute for such a complete census as was planned. Certain groups of the unemployed will be reported with varying degrees of completeness and the extent to which employment office registration represents total unemployment in any community will vary from one section of the country to another. Nevertheless, in addition to its primary object of indicating the number, type and background of the registered job seekers of each state, information hitherto unobtainable except in a few scattered communities, the Employment Service inventory will furnish the most comprehensive and authoritative sample of unemployment statistics yet available.

*Occupational Research Program:* Supported in part by grants of funds from the Social Science Research Council and the Spelman Fund and in part from regular appropriations, the United States Employment Service is also conducting other studies of wide social significance. In an effort which is ultimately aimed at facilitating the transfer of workers from depressed in-

dustries and occupations to those of more promise with a minimum loss of experience and training, the United States Employment Service has set up an extensive program of job analysis and worker analysis to determine the special skills and aptitudes necessary for success in various occupations.

In order to aid in the process of industrial reabsorption, the Occupational Research Program is designed, in the first place, to provide detailed and accurate descriptions for all jobs available and served through an employment office, and secondly, to develop a classification or grouping of such jobs in terms of the human qualifications required to carry on the work successfully.

Millions of unemployed persons in this country are seeking to secure employment in the specific occupations for which their particular training and ability suits them. Preliminary estimates made from the active files of Employment Service offices show that nearly a third of the registered job-seekers are younger persons, between the ages of sixteen and twenty-four, who because of recent economic conditions have been unable to secure regular employment and, therefore, have no work history of any significance. It also appears that somewhat less than one-half of the adult workers actively seeking work through the offices have had experience only in those occupations for which there is no immediate or prospective demand.

This would suggest that not many more than a third of the persons now actively seeking work through the public employment service can hope, even under improved conditions, to secure employment in those occupations in which they have had extensive experience. If two-thirds of the unemployed persons are to be reabsorbed into industry as business activity expands, a major program must be undertaken to facilitate occupational readjustment. It is essential to know what other kinds of work each of these persons is capable of doing, in addition to those jobs in which he may have had some experience. It is also necessary to know what types of jobs are available and exactly what they require in the way of abilities, skills, and aptitudes on the part of the workers.

In order to serve these objectives, a program of occupational research studies is being carried on under the direction of a technical board of outstanding experts in the field of occupational analysis. The members of this board were appointed by the Director of the United States Employment Service from nominations offered by the Social Science Research Council and the National Research Council. Those members of the Technical Board who were nominated by the Social Science Research Council are primarily concerned with the development of sound job specifications and an improved cross-classification of occupations. The members nominated by the National Research Council are primarily concerned with the development of occupational standards and practical criteria for selecting workers for employment, especially those who cannot be placed in terms of previous work histories.

WORKS PROGRESS ADMINISTRATION.—In the last issue of the JOURNAL a brief statement appeared outlining plans for the collection and presentation of

periodic reports of employment and progress on all projects under the Works Program, with the responsibility for which the Federal Works Progress Administration was charged under the terms of Executive Order 7034. The following paragraphs will explain in greater detail the organization which has been established for the collection of these data.

Decentralization of the reporting functions of the Works Progress Administration was decided upon after consideration of works program reporting problems and of the experience gained by the Federal Emergency Relief Administration during the last two years. To require each of the State Works Progress Administrations to set up a statistical staff able to meet varying demands for detailed information would have added a heavy burden to the administrative responsibilities of the State office. Maximum flexibility in reporting forms and instructions is required because of the many independent administrative agencies participating in the program, and because of the likelihood of shifting emphases in the program.

Instead of preparing reports on various phases of the program, each State and district Works Progress Administration office is required to forward to one of the 11 Area offices which have been established, legible carbon copies of administrative and accounting documents such as assignment slips, payrolls, and certifications of sponsor's contributions. Copies of procurement documents will be obtained from the Treasury procurement offices. Arrangements have been made to have the Area offices receive also copies of assignment slips, payrolls, purchase information and progress reports for all projects operated by other Federal agencies. Using these documents, the Area offices are maintaining detailed records by counties, by agencies, by types of projects, etc.

Only two major exceptions to this policy are contemplated. One relates to reports of administrative expense which will involve a report from district to State Works Progress Administration offices, and reports from the States to Washington. The other concerns reports on the progress of projects. A Report of Physical Progress will be prepared for the State Works Progress Administration by the district office from its project registers and from field engineers' reports. The State office will make such analysis of this report as it may wish immediately, but the summary report to Washington will be prepared by the Area office from carbon copies of the State report.

Copies of all reports prepared by the Area statistical offices will be sent to State Works Progress Administrations for administrative use and to the Washington office where United States summaries will be made available for general distribution.

FEDERAL EMERGENCY RELIEF ADMINISTRATION.—*Occupational Inventory of the Relief Population.* An occupational inventory of all persons receiving relief in March 1935, who were working or seeking work, classified according to "first priority" and "all priorities", has been completed. The first complete monthly labor inventory of relief clients eligible under the Works

Progress Administration was made, beginning November first, carrying out an original plan of making periodic checks on the employment of the relief population under the Works Progress Administration.

*Surveys of Job Refusals.* Studies of alleged job refusals by relief clients, during the months of April, May and June, have been made for Baltimore, Maryland; Hammonton, New Jersey; Washington, D. C.; Allegheny County, Virginia; Memphis, Tennessee; and Buffalo, New York.

*Unemployables.* In view of the probable consideration of social security legislation in a good many states during the coming year, a number of Federal and State agencies are seeking to learn, through WPA projects and otherwise, the total number of unemployable families who would be eligible for social security assistance. An inter-departmental committee has been set up representing the various Federal agencies interested in this problem for the purpose of drafting a standard procedure to be used in obtaining the necessary data for the various States.

*Survey of Current Changes in the Urban Relief Population.* An important addition to the Urban Current Change Studies in 13 cities is a sample study of the employment history of relief families, as they are transferred from relief rolls to Works Progress Administration employment or into private employment. This study was begun in October.

*Survey of Relief Cases in Georgia Closed for Administrative Reasons.* A survey of relief cases closed for administrative reasons in Atlanta and Macon, and in 17 rural counties in Georgia during May and June was completed in October. The economic status of the households from July 15 to August 15, 1935 was compared with their condition during the last full month on relief.

*Survey of Current Changes in the Rural Relief Population.* Relief records for June were taken in more than 300 counties in 32 states, and a study of cases closed from February to June has been completed. A county schedule designed to measure monthly relief turnover in rural areas, beginning with July, giving the total monthly accessions to the relief rolls as well as total monthly separations is now being used. The closed cases are tabulated according to whether they were removed from relief by the Works Progress Administration, by the Resettlement Administration, and for all other reasons. In addition to the county schedule, a case schedule is being used to sample E.R.A. accessions and separations during July and succeeding months. A sampling study of all rural relief cases remaining on E.R.A. rolls in October is under way, and a follow-up study will be made of a sample of cases closed since June.

*Survey of Rural Relief and Non-Relief Families.* A comprehensive report based on material collected in this October 1933 survey (much of which has already been released in preliminary bulletins) is being issued as a Research Monograph.

*Study of Transient Family Groups.* The purpose of this study was to show in considerable detail the personal and occupational characteristics of all members of transient families. In addition, information was obtained

on the residence history of families before migration, the time and reason for migration, the number of registrations and the duration of stay in transient bureaus, and the agricultural experience of the principal members of each family group. The study was made in 87 cities selected to provide a sample proportionate to the transient family case load in each of the States. In all, about 5500 cases were included in this study.

*Sales Taxation.* This investigation is intended to reveal the importance of sales tax revenue in the financing of emergency relief by the various State governments. The study covers the 24 States which now tax (with exceptions noted in the taxing law) all business sales of tangible personal property at either the manufacturing, wholesaling, or retailing point. The factual results of the study are summarized in 4 tables to be published in the Monthly Report of the Federal Emergency Relief Administration.

*Sectional Economic Research.* Studies have been made of economic sections of the United States to indicate the productive industries or agricultural products which are fundamental to the economy of each section. In order to determine factors vital to the stability of basic industries, preliminary surveys have been completed for the following industries: bituminous coal, anthracite, copper, lead and zinc, transportation, cement, lumber, steel and non-metallics.

COORDINATING COMMITTEE OF THE CENTRAL STATISTICAL BOARD AND THE WORKS PROGRESS ADMINISTRATION.—Membership of the Committee was completed in July, to include: Dr. Theodore J. Kreps, Professor of Statistics and Economics, Stanford University; Chairman; Mr. Howell Cheney, Chairman of the Board of Directors, Cheney Silk Mills; Mr. Robert P. Lane, Executive Secretary of the Welfare Council of New York City; Dr. Theodore O. Yntema, Professor of Economics, University of Chicago. Ex-officio members include: Mr. William J. Carson, Acting Executive Secretary of the Central Statistical Board; Mr. Corrington Gill, Assistant Administrator of the Works Progress Administration; Mr. Charles W. Elliott, Executive Officer of the National Resources Committee. Dr. Kreps has resigned from the Chairmanship due to expiration of his leave of absence from Stanford University. He will continue to assist the Committee as Special Consultant, being available for such time as can be spared from his academic duties. Dr. Stuart A. Rice, Acting Chairman of the Central Statistical Board, was asked to assume the additional responsibility of the Chairmanship of the Coordinating Committee, with Mr. Charles F. Beach serving as Executive Secretary.

Approximately forty per cent of the local project applications reviewed by the Coordinating Committee to date have been disapproved to avoid duplication of subject matter, respondents, or both, or because of technical inadequacies or unsuitability for prosecution with relief personnel. A large number of the projects which have been approved were adjusted by the

sponsor at the Committee's request, to remove one or more of the above objectionable characteristics.

Six Federal projects, totaling nearly $12,000,000 in cost, have been approved and are in process of initiation. The largest of these is the Census of Business Enterprise, 1935, to canvass all business activities with the exception of agriculture and manufacture. The other Federal projects provide for maintaining currently an inventory of applicants registered at employment offices; studies not heretofore available of partnership income tax returns, of personal returns in the lower brackets, of business returns and of fiduciary returns; the development of a sampling technique for estimating volume of retail trade for constructing a monthly index; a study of occupational classifications, including job analyses in a number of industries; and an alphabetical index of persons included in the Census of 1900, to facilitate the administration of the Social Security Act.

OFFICE OF EDUCATION.—The "Economic Outlook in Higher Education for 1935–36" will be published about the first of November. The preliminary statistics released in August for the public school systems in 41 States are available now for all States and will be published in *School Life*.

WOMEN'S BUREAU, U. S. DEPARTMENT OF LABOR.—Since the relation of unemployment to improved technological processes constitutes one of the most serious of present day industrial problems, the Women's Bureau conducted a study of technological changes occurring between 1921 and 1931 in 115 factories, located in 32 cities in 9 Eastern and mid-Western States. The 250 changes selected for study were those in which women were particularly involved and the great majority took place in the more recent 5-year period, 1927 to 1931. Machine improvements and operating changes or different work set-up, either alone or accompanied by other changes secondary in importance to them, comprised three-fifths—59.6 per cent—of the total number of technological changes studied. The two other most frequent changes were from hand to machine work and substitution of women for men.

As a result of the changes, employment decreased or remained stationary in a little over nine-tenths of the cases reported. Taking the group as a whole, before the technological change, 6,401 workers were employed on the operations studied, but 6 months or more after the change the number was only 3,604, a reduction of 43.7 per cent. This decrease in every case was reported to be due to improved technology and not to lessened factory output. The largest reduction in employment occurred in the change from hand to machine work, where machines displaced 70.5 per cent of the workers. Moreover, nearly one-half of the women earned less after the change than before.

The changes were always made with the purpose either of reducing the cost per unit of output or of increasing the production per worker. That these objectives were accomplished is shown by the fact that in 70 per cent

of the cases, the changes resulted in production increases ranging from less than 10 to at least 1,000 per cent.

The Women's Bureau will soon release for publication a study of "Employed Women Under N.R.A. Codes," analyzing the wages and hours provisions of 491 of the 570 codes approved up to March, 1935, as well as other provisions of particular importance to employed women or woman-employing industries. Although the study is not a field survey of the effects of the codes, what field studies have been made have been brought together and any available indications of changes in employment, wages, and hours of work for women are considered.

Instances are cited showing the widespread effect of code minima in bringing up both the hourly and weekly earnings of very large numbers of women who were at the lowest wage levels. The principle of the basic 40-hour week, established in approximately seven-tenths of the codes analyzed, is pointed out to have benefited workers in some of the most important woman-employing industries, such as most of the textiles, laundries, boots and shoes, cigars, cotton garments, and several in the food group. Definite increases in employment of women and some indication of greater regularization are shown to have followed the recovery program.

Certain defects of the N.R.A. codes and their results are also analyzed. The fact that nearly one-half of all employed women did not come under the codes, the lowered minimum wages fixed on various differential bases, such as geographic location, sex, or size of city as well as lowered minima for handicapped workers and learners, the failure to prohibit homework in all codes covering industries in which homework is done, hour standards too long to bring about any great increase in employment in many industries, and the problem of maintaining wage standards above the minimum for those who had received, or who in view of their type of work, should receive more than the minimum are also discussed.

CHILDREN'S BUREAU, U. S. DEPARTMENT OF LABOR.—The past months have been marked by preparations for administration of those sections of the Social Security Act relating to maternal and child health and child welfare, and to consultation with the States to assist them in the development of their plans for the several types of activity in this field for which the Act provides Federal grants-in-aid.

Although the program will be closely integrated, the services provided for under Title V, Parts 1, 2, and 3, of the Social Security Act, will have to be administered separately, as each part carries authorization for a separate appropriation to enable the States to develop a different and specialized activity.

For administrative purposes the Children's Bureau has set up three divisions: a Maternal and Child Health Division, to administer the annual appropriation of $3,800,000 authorized by the Act for the purpose of enabling the States to extend and improve, as far as is practicable, their services for pro-

moting maternal and child health; a Crippled Children's Division, to administer the annual appropriation of $2,850,000 authorized to enable the States, through the State agencies concerned, to extend and improve services for locating crippled children, and for providing medical, surgical, corrective, and other services and care, and facilities for diagnosis, hospitalization, and aftercare for crippled children or those in danger of crippling; and a Child Welfare Division, to administer the $1,500,000 authorized annually for enabling the Federal Government to cooperate with the States in developing their welfare services for homeless, dependent, and neglected children, and those in danger of becoming delinquent.

The Maternal and Child Health and the Crippled Children's Divisions will be headed by physicians, under the general supervision of the Assistant Chief of the Children's Bureau who is also a physician. The Child Welfare Division will be headed by a social worker under the general supervision of the Chief of the Bureau.

The Children's Bureau will be assisted in its administration of the Act, by a national advisory committee. The three divisions will be assisted by special advisory committees composed of authorities in the special field of activity concerned.

The provisions of the Social Security Act relating to maternal and child welfare have been summarized by the Children's Bureau in a bulletin, "Grants to States for Maternal and Child Welfare under the Social Security Act," which describes in detail the provisions of these parts of the Act, the purpose of the Federal grants, provisions for Federal administration, the amounts available to the States and method of payment, and the requirements for State plans. The bulletin also contains a tabular summary of provisions for grants to States for maternal and child welfare and the text of the sections of the Act relating thereto. There is also a brief summary of the provisions of Title IV of the Act, authorizing an annual Federal appropriation to make grants to States which have State plans for needy dependent children under the so-called mothers' assistance or mothers' aid laws. This Title of the Act is to be administered by the Social Security Board.

U. S. Public Health Service.—*Health Inventory of 750,000 Families.* Through an allotment of $3,450,000 from the Works Progress Administration, the United States Public Health Service is now conducting a health survey in selected localities in nineteen states,—Alabama, Georgia, Louisiana, Maryland, Texas, Virginia, California, Oregon, Utah, Washington, Illinois, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, and Pennsylvania.

Briefly the primary purposes of the survey are:

(1) To find the extent of time lost from work, school or other usual activities on account of chronic diseases, and to record the prevalence of such serious physical impairments as lost and crippled arms and legs and the cause of the condition in terms of accident or disease. In addition to the

duration of disability, a record of certain factors having a bearing on health such as occupation, family income, housing conditions and medical care received for illness, etc., are being obtained. Both rural and urban populations will be covered, although the urban will greatly predominate.

The survey will include 750,000 families selected to be representative of the general population of various income levels and thus yield information upon the relationship of disabling illnesses and physical impairments to economic and social status. It is hoped that an analysis of these data will provide important facts upon which more effective measures of prevention and control of chronic illnesses may be established by Federal, state and local health agencies.

(2) Complementary to the general survey of disabling illness, a detailed study is being made of the public health, hospital and clinic facilities in the same states. In most instances studies will be made of these facilities as related to counties and larger cities as units of population, but where indicated trade areas or states will be taken into consideration. A composite picture is desired including all agencies, hospitals, clinics, and public health organizations, both official and voluntary, with information on their resources and personnel. In this way the amount of illness can be related to the facilities and an estimate made as to the general needs of the situation.

(3) A study will also be made of the data recorded by industrial sick benefit associations in order to obtain sickness and mortality rates according to specific occupations. This information is needed for effective direction of national, state and local programs of industrial hygiene and disease prevention in the adult population.

It is believed that this survey is the most comprehensive of its kind ever undertaken in this or any other country. The schedules have been devised along the lines of previous smaller health studies of proven utility in Hagerstown, Md., Syracuse, N. Y. and Cattaraugus County, N. Y.

CONFERENCE OF BRITISH COMMONWEALTH STATISTICIANS.—From September 13th to October 9th, 1935, Statisticians from the various parts of the British Commonwealth were in Conference at Ottawa, Canada. This is the second conference of the kind to be held, the first taking place in London in 1920. In addition to the Canadian delegation there were representatives from United Kingdom, Australia, New Zealand, Union of South Africa, Irish Free State, Newfoundland, and India. The chief objective of the Conference was the erection of standards, both of content and method, in each important statistical field to form bases of comparison between the various countries in the British Commonwealth of Nations. The field covered some twenty subjects including statistics of: Agriculture, Forestry, Mining, Fisheries, Trade, Labour, Prices, Balance of International Payments, Road Transport, Industrial Production, etc. Some hundred resolutions were passed which will be embodied in the Report to be issued in due course.

UNIVERSITY OF LONDON, UNIVERSITY COLLEGE.—Readers may be interested to hear of further changes that are occurring this fall in the field of Statistics at University College, London. On Karl Pearson's retirement two years ago it was decided by the University to create separate Departments of Eugenics and of Statistics. Dr. R. A. Fisher became head of the former as Galton Professor of Eugenics, while Dr. Egon S. Pearson was made head of the latter. The University has now conferred the title of Professor on Egon Pearson. At the same time Dr. J. Neyman, docent at the University of Warsaw and head of the Biometric Laboratory there, who has been working in London during the past year, has been appointed to the University Readership in Statistics under Pearson in succession to Dr. Ethel M. Elderton who is retiring.

Miss Elderton has been associated with Francis Galton, his Laboratory and University College for more than 30 years. She received her first training in Statistics from Galton himself when she became his personal assistant in 1903. In 1904 she became secretary to his Eugenics Record Office. Two years later Galton transferred this Office to the charge of Karl Pearson, then Director of the Biometric Laboratory at University College, and it was reconstituted as the "Laboratory of National Eugenics" with Miss Elderton, in succession, as Galton Scholar, Galton Fellow, Reader in Eugenics and finally Reader in Social Statistics. To that small group of statisticians who have crossed to London to work in Karl Pearson's Laboratories her name will recall many warm memories of the past.

Jerzy Neyman is a mathematical statistician who has not only given much study to the theory of probability, but has considerable practical experience in the field of agriculture, biology and sociology. In the last seven years he has published a number of papers jointly with Egon Pearson discussing the principles underlying the methods of statistical inference. We shall hope for further interesting results from the closer collaboration between them in teaching and research that will now be possible.

THE COMMITTEE ON PUBLIC ADMINISTRATION of the Social Science Research Council in announcing the appointment of Charles S. Ascher as Secretary and Joseph P. Harris as Director of Research, has issued a statement of a research program which suggests closer relations between statisticians and students of public administration.

The Committee feels that with the increased scope of governmental activities, those who must make administrative decisions should be in a position to profit by recent and current experiences and have made available to them the best results of comprehensive study and research. The Committee's program has a double aspect. On the one hand, it will seek to capture and record administrative experience, obtaining its reports in large measure from those who are or have been actors in the scene while the events are still fresh in their minds; and it proposes to conduct studies of this character under its own auspices, to explore the organization and operation of some of the

important new governmental agencies as institutions and to throw light on new Federal-state-local relationships, and new devices for the coordination of policy and integration of administration, and other developments arising from the new undertakings.

On the other hand, the Committee recognizes that many studies of one phase or another of these problems are now being carried on or are being contemplated in institutions all over the country—not only in departments of political science of the universities but in other academic departments, in agricultural experiment stations, by the research staffs of governmental agencies, and in private research bureaus. The Committee hopes to be able to act as a clearing house, to prevent duplication of effort, perhaps to suggest the re-direction of certain studies so as to deal with administrative questions. It hopes to be able to put before research groups problems that confront administrators and to interpret to officials the results of research coming to its attention.

The Committee recognizes that the analysis of the effectiveness of governmental devices used to meet a given problem cannot be made by students of administration alone, but that they will have to call upon experts in statistics, finance, labor relations, transportation, agricultural economics, housing, planning and the many other disciplines involved in present day governmental activity. It believes that there are many problems of administration susceptible of measurement and statistical treatment for which techniques have not yet been devised and hopes to interest statisticians who may not heretofore have concerned themselves with administration, to apply their skills to the problems which vex administrators. It is only by such interdisciplinary group-thinking that the complex problems of modern administration can be solved.

The Committee headquarters are at 850 East 58th Street, Chicago, Illinois. The members of the Committee are Mr. Louis Brownlow, *Chairman*, Mr. William Anderson, Miss Adèle Clark, Mr. John Dickinson, Mr. Harold W. Dodds, Mr. Luther H. Gulick, Mr. Lewis Meriam, Mr. Lindsay Rogers, and Mr. Harold D. Smith.

Milbank Memorial Fund.—Among the statistical studies which the scientific staff of the Milbank Memorial Fund is conducting are surveys in several localities to determine the amount and kind of health services that have been rendered to families of different income levels and how far these services met some of the needs and were adequate when given. In cooperation with the United States Public Health Service, a random sample of about 5,000 persons in Syracuse, New York, and a similar population group in rural Cattaraugus County, New York, were observed for eighteen months and three years, respectively. In New York City, two districts were selected for a study of services, one the district observed by the Bellevue-Yorkville Health Demonstration, and the other the Mott Haven health district which did not have localized public health administration. Another set of studies are of

the health supervision of an unselected series of maternity cases in rural, urban, and metropolitan areas.

A study of the health status of a rural population in Cattaraugus County, New York, has also been completed. Medical examinations were given to a random sample of about 1,400 persons in the same area in which a morbidity survey was carried on continuously for three years. It is believed that the records so obtained will yield the first data ever assembled for a typical cross section of rural families with respect to the prevalence of defects and diseases such as heart and kidney diseases, tuberculosis, and syphilis. The data will reveal also how many conditions had received treatment, were known but had not been treated, or were undiagnosed.

In the field of population studies, the analysis of unpublished census records for 1900 and 1910 relating to differential fertility is being supplemented by special field studies. Data for approximately 20,000 families in various types of communities have been accumulated and are now being analyzed. Records similar to those secured by field studies in this country have been obtained in China, in cooperation with the University of Nanking, for about 30,000 families of Chinese farmers.

PSYCHOMETRIC SOCIETY.—At a meeting which was held in Ann Arbor, Michigan, September 4, 1935, the Psychometric Society was formally organized and the following officers were elected: President, L. L. Thurstone; Secretary, Paul Horst; Treasurer, Jack Dunlap.

A proposal for affiliation of the Psychometric Society with the American Psychological Association was presented to the American Psychological Association and accepted at its annual business meeting. The provisions of the affiliation specify that all officers of the Psychometric Society shall be members or associate members of the American Psychological Association, that the Year Book of the American Psychological Association will contain a list of these officers and will indicate in the membership list of the Association those members who are also members of the Psychometric Society, that the Program Committee of the Association will schedule one or more formal sessions on psychometrics for which the Society will be responsible, subject to certain regulations, and that the Psychometric Society will not ask the American Psychological Association to assume any responsibility, financial or otherwise, for the conduct of the affairs of the Psychometric Society.

The objectives of the Society are set forth as follows: "The primary purpose of this organization is to promote the development of quantitative rationale in the solution of psychological problems. This necessarily means the formulation of hypotheses in mathematical form, their development into a consistent quantitative psychological theory, and quantitative tests of the agreement between theory and the experimental data. The principal objective is the development of a psychology which is quantitative in the sense used in natural science."

The means under consideration for realizing these purposes are the holding

of periodic meetings with planned programs, and the publication of a journal to be known as "Psychometrika." The meetings should preferably be held concurrently with meetings of the American Psychological Association.

The journal, as projected, will contain articles on the following subjects: (1) the development of quantitative rationale for the solution of psychological problems, (2) new mathematical and statistical techniques for the evaluation of psychological data, (3) aids in the application of statistical techniques, such as nomographs, tables, work-sheet layouts, forms, and apparatus, (4) critiques or reviews of significant studies involving the use of quantitative techniques, and (5) general theoretical articles on quantitative methodology in the social and biological sciences.

The next annual meeting of the Society will be held at Dartmouth with the American Psychological Association.

## PERSONAL NOTES

S. A. Cudmore of the Dominion Bureau of Statistics has been loaned for three years to the Government of Palestine to take charge of and organize in that country a Bureau of Statistics on the same principle and practice as the Canadian Bureau. Mr. Cudmore is an honours graduate of Toronto University, and, after winning the Flavelle Scholarship, proceeded to Oxford. For several years he was professor of economics at Toronto University and fifteen years ago was appointed Editor of the *Canada Year Book* and chief of the General Statistics Branch of the Bureau. He is one of the three Canadian statisticians who have been elected to membership of the International Institute of Statistics.

On September 17, 1935, President Roosevelt appointed Dr. Stuart A. Rice as Acting Chairman of the Central Statistical Board to fill the vacancy created by the resignation of Dr. John Dickinson. Dr. Rice is Assistant Director of the Bureau of the Census and has been First Vice Chairman of the Central Statistical Board.

Mr. Ernest G. Draper, Assistant Secretary of Commerce, has become a member of the Central Statistical Board in place of Dr. Dickinson. Messrs. L. C. Marshall and William J. Maguire (alternate) have replaced Messrs. Leon Henderson and T. J. Kreps (alternate), as representatives of the National Recovery Administration.

Dr. Theodore J. Kreps resigned as Chairman of the Coordinating Committee of the Central Statistical Board and the Works Progress Administration on October 4, 1935, to resume his duties at Stanford University. Dr. Stuart A. Rice, Acting Chairman of the Central Statistical Board, has been appointed Chairman of the Coordinating Committee to succeed Dr. Kreps, and Mr. Charles Beach has been made Executive Secretary of the Committee.

Mr. W. F. Callander, since 1923 Chairman of the Crop Reporting Board, has been appointed Assistant Administrator of the Agricultural Adjustment Administration effective August 16.

Mr. Joseph A. Becker has been appointed Chairman of the Crop Reporting Board, United States Department of Agriculture, effective August 16.

Mr. M. A. Girshick has been appointed as Research Assistant at Columbia University, under a grant from the Carnegie Corporation, to carry on research in Mathematical Statistics under the supervision of Prof. Harold Hotelling. Mr. W. G. Madow will continue in the same capacity for the coming year. Dr. Joseph L. Doob, who was working under this grant during the year 1934–35, has left to become a member of the department of mathematics of the University of Illinois. Miss Margaret Richards, who has also left this work, married Mr. W. R. Pabst of the Cornell economics department and has been appointed assistant in the College of Agriculture at Cornell. Before leaving Columbia she completed a study in the theory of rank correlation now on its way to publication.

Dr. Carl C. Taylor has been designated by Secretary Wallace to head the Division of Farm Population and Rural Life in the Bureau of Agricultural Economics. This division studies farm and rural social problems and issues annual estimates of changes in farm population. Dr. Taylor is also Director of the Rural Resettlement Division of the Federal Resettlement Administration. He will continue in this work, having been designated a collaborator.

Prof. F. L. Carmichael, Director of Business Studies at the University of Denver, is now in Washington, D. C. supervising an Urban Relief Study under the F.E.R.A.

## C. W. L. Charlier

Statistical science suffered an almost irreplaceable loss when Professor Carl Wilhelm Ludvig Charlier died on November 5, 1934, after two years of severe illness.

Charlier was born in 1862. In 1897, after a fine academic career, he was appointed professor of astronomy at the University of Lund, from which post he retired in 1927.

From the beginning to the end of his long and uninterrupted work Charlier's scientific activity was exceptionally comprehensive, though, during different periods of his life, different parts in the vast field of mathematical science absorbed his interests and labour. In his earlier years Charlier devoted himself to celestial mechanics on which he published an appreciated textbook. After 1904 he devoted more research and instruction to the calculus of probability and to mathematical statistics. His first task was to lay a firm theoretical basis for the reconstruction of the general theory of frequency distributions of one variable. His starting point was from some half forgotten mathematical developments in Laplace's *Théorie analytique des probabilités;* in 1905 he showed that the theory of the composition of elementary errors, which Laplace had formed *in nuce,* led to two general types of frequency curves, now called A- and B-curves. Some years later he found that the same principles were applicable in the general theory of

frequency distributions of two or more variables. In a long series of essays he continued to strengthen the basis for theoretical statistics at several points. It may be mentioned as characteristic that in his instruction he gave his pupils generous suggestions for new lines of research, and also that, probably on account of his astronomical training, he never neglected to give detailed instruction about practical applications of his new or modernized theories to concrete statistical problems. His appropriate and time-saving arrangement of arithmetical work was always excellent. Wherever possible, he gave directions for the effective control of computations.

The new working methods, which in our century have been devised by Charlier, Edgeworth, Pearson, Tschuprow and others, he used chiefly for the solution of actual problems in stellar statistics, in the first place the problem of the deduction of the real distribution and motions of the stars from their apparent proper motions, radial velocities, magnitudes, spectral classes, etc. A review of his most important results in stellar statistics, interesting also to statisticians not astronomers, may be found in the lectures he delivered in 1925 as a visiting professor at the University of California and published in "California Lectures," as well as in a volume, edited in French, of the encyclopaedia *Traité du calcul des probabilités et ses applications.*

Charlier's statistical work has been of great importance, especially in Scandinavia, to the social and actuarial sciences, as well as to biology and other fields which, nowadays, include statistics in their working methods. He was a pioneer in developing academic instruction in statistics; the chairs of statistics at the two Swedish State Universities are now occupied by his pupils.

Charlier's personality was of an extraordinary grandeur, and to his disciples he was an affectionate, unselfish adviser and friend.

*Uppsala, July, 1935* F. J. LINDERS

## Margaret Hope Hogg

After a year of painful illness following a serious operation in the summer of 1934, Margaret Hope Hogg died on August 3, 1935. Her death occurred at sea, her physicians having consented to her return to her home in England in the hope that the voyage might improve her condition. Miss Hogg had been a valued member of the staff of the Russell Sage Foundation for the preceding eight years and during the last year of her active work, while on leave from the Foundation, was a member of the research staff of the Committee on Governmental Statistics and Information Services in Washington.

Miss Hogg was born in Edinburgh, Scotland, on October 15, 1894. Her father was the late Professor Hope W. Hogg of the University of Manchester. Miss Hogg held the degrees of B.A. and M.A. from Newnham College, Cambridge, from which she was graduated in 1917. From 1919 to

1925 she was Assistant in Statistics at the London School of Economics. In 1925 she came to this country and for two years was Instructor in Economics at Smith College, following which she was employed as Research Statistician by the Russell Sage Foundation. Miss Hogg had gained recognition as an authority in particular in two fields of social statistics, unemployment and cost of living. In both of these fields she had made important contributions and in both fields she assisted the Committee on Governmental Statistics and Information Services in its investigation of the statistical work of the Federal Government.

With Professor A. L. Bowley, Miss Hogg was joint author of *Has Poverty Diminished?*, published in 1925, which recorded the results of post-war investigations into the economic conditions of working class families in English towns. Her outstanding publication in the field of unemployment statistics was *The Incidence of Work Shortage,* published in 1932, which presented the methods and results of an experimental survey of unemployment made under her immediate direction in New Haven, Connecticut. Some of the results of her most recent work are contained in a joint article by Miss Hogg, Dr. Faith Williams and Dr. Ewan Clague, in the Septemebr issue of the *Monthly Labor Review* of the United States Bureau of Labor Statistics. During her employment at the Russell Sage Foundation much of her time was given to consultation. Her acute reasoning power and high standards of workmanship were thus instrumental in improving the plan of work and the product of many other investigators of social conditions. In her premature death the cause of social statistics in the United States has suffered a great loss.

RALPH G. HURLIN

## NEW MEMBERS

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# REVIEWS

*Mechanization in Industry,* by Harry Jerome. New York: National Bureau of Economic Research. xxxi, 471 pp. 1934.

The significance of certain predictions proffered in *Mechanization in Industry* is best revealed by the predictions themselves. "It does not appear probable that in the near future conditions will be exceptionally favorable for rapid mechanization" (p. 21). "The net balance of favorable and unfavorable factors is, in the judgment of the writer, on the side of a renewal of the trend toward higher mechanization, at a moderate rate at least, when prosperity returns and where there is still considerable room for further reduction of manual operations" (pp. 363, 364). "Contrary to the more or less prevalent concept of modern industry as almost entirely a machine process, the estimates of the proportion of machine workers indicate that there are . . . large numbers of workers in most industries whose work is essentially hand rather than machine. Something of the large potentialities for still further progress in mechanization is thus apparent" (p. 276).

The study further concludes: "No more likely than a near cessation of mechanical progress is the danger of an uncontrollably rapid mechanization" (p. 19). "There are two prerequisites for changes in industrial technique. First, certain scientific and engineering principles must be evolved; second, their application must be commercially feasible" (p. 330). "Technical progress far outruns actual practice" (p. 331), and "it would appear probable that technical difficulties will be hurdled with greater and greater ease" (p. 363).

The study indicates that lag in the rate of commercial absorption of mechanical progress serves as a brake on rapid change, and it is with something of a feeling of assurance that one reads that "changes in the rate [of mechanization] . . . are within limits that are to a reasonable degree predictable" (p. 21) and that ". . . the effects can be foreseen and ameliorated" (p. 22).

Of the effect of mechanization on the skill requirements of the worker of the future, the conclusion is: "There is considerable reason to believe that the effect of further changes will be to raise the average skill required" (p. 402). "Probably the aggregate effect may be accurately described as a leveling process producing fewer highly skilled jobs but also few really unskilled jobs" (pp. 400, 401).

Of the effect of future mechanization on displacement of labor, one reads: "In general, the writer does not find convincing the evidence of theoretical arguments sometimes advanced to demonstrate an inherent tendency for mechanization to create an ever larger permanent body of unemployed" (p. 387).

In *Mechanization in Industry,* Mr. Jerome is presenting a report of the

results of a survey conducted under the auspices of the National Bureau of Economic Research with the aid of the Social Science Research Council. The study confines itself to characteristics, causes, and significance of current changes in mechanization and does not essay the appraisal of the relative merits of machine and handicraft civilizations.

The survey and field work cover a period of about nine years. They include the interpretation of mass data such as those presented by census reports; the compilation and analysis of data from business and technical periodicals and from questionnaires completed by business executives; and, in several industries, direct collection of materials by field representatives.

This mass of diverse material is the basis of the conclusions presented in the report. In many instances these are based upon the author's judgment of the evidence, and frequently the evidence is conflicting. Particularly is this conflict true in the attempts at quantitative measurement. The 1929 Census of Manufactures figures for horsepower per wage earner in the manufacturing industries show no relation to size of establishment either for industry as a whole or in selected industries. Here, Mr. Jerome concludes: "Other information at hand evidences more clearly a tendency for the degree of mechanization to vary directly with the size of the manufacturing plant" (p. 265). When the 16 industrial groups in manufacturing are ranked by two measures of mechanization, the rankings vary greatly. When percentage ratio of wages paid to value added by manufacture is used as the measure, tobacco manufactures rank first—the most highly mechanized of the 16 groups. When horsepower per wage earner is the measure used, tobacco manufactures rank sixteenth—the least highly mechanized of the 16. On the first basis, iron and steel and their products not including machinery rank thirteenth; on the second basis, they rank first. "Remembering the various limitations upon the accuracy of each method, the differences are no more than would be expected." Attempts to refine these measurements yield equally inconsistent results.

*Mechanization in Industry* makes substantial contributions to our understanding of the subject. But in the reviewer's opinion the contributions are not in the quantitative appraisals of the present nor in the forecasts of the future. They are to be found, rather, in Mr. Jerome's thoughtful, analytical refinement of our common conception of the causes, nature, and processes of mechanization. Failure in anything like precise measurement was inherent in the data and devices employed. The forecasts of the future are further questionable because of a factor referred to several times in the report. Mechanization can be no more rapid than progress in the various related techniques of industrial management. Nor can results of mechanization be isolated from the effects of these other techniques. The use of the machine is not the only means of increasing labor productivity, and it is probable that labor displacement of the future will occur at a pace which cannot possibly be accounted for by increasing mechanization. This report does not

give the answer to the industrial situation, but it does advance the understanding of the thoughtful reader.

FRANKLIN E. FOLTS

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*La previsione delle crisi e la disciplina dell' attività produttiva,* by Livio Livi. Florence: Rinascimento del libro. 1934. 117 pp. 15 lire.

The bold generalizations in which this book abounds are likely to meet with more opposition than assent. Yet the very fact that the propositions advanced and the statistical "proof" provided in support of them are such as to invite criticism should be accounted one of its merits; for this criticism should lead to the further investigation of fields still largely uncultivated.

The volume undertakes to present "a method of forecasting based on disequilibrium between capacity to produce and capacity to consume" (pp. 5 ff.). Only those blinded by a premature haste to misapply Say's "Law of Markets" would dismiss *a priori* the possibility of such a "disequilibrium." Such misgivings as one has at the outset—and they have not been laid to rest by recent American adventures in the field—will derive, in the first place, from a fear that the analytical possibilities inherent in the notions represented by the two "capacities" will be slurred over in an attempt to get quickly to certain statistical "measures" of the respective "capacities"; and, in the second place, that—partly as a result of the slurring over of these analytical possibilities—the *explanation* given of the alleged "disequilibrium" between the two "capacities" will leave much to be desired from the standpoint of logical rigor. It is to be feared that the volume under review does not tend to remove these misgivings.

The fundamental difficulty, for example, with the concept of "capacity to produce" is that, in a changing world, any measure of such "capacity" which does not place the greatest possible emphasis upon the *qualitative* aspect of the producers' goods involved tells us very little indeed. How many of the looms in existence, for example, are capable of producing at a level of costs consistent with the price situation which has been brought about by changes in demand that may be regarded as fairly permanent? It is perfectly possible, under such conditions, that much of the existing plant may be so obsolete as to deserve no place in the magnitude designated as "capacity to produce," for the simple reason that they *cannot* "produce" at costs which would make production anything but a tragic waste of resources.

The significance of this central consideration, which the author seems to recognize at some points (e.g., pp. 52, 69), only to dismiss it as being of secondary importance, becomes clear as soon as we examine his own explanation of the "constant difficulty" of adjusting the two "capacities" to each other. In general, the author's contention is that "free initiative" on the part of private producers and the price-system which guides that "free

initiative" have shown themselves entirely incapable of providing the basis for a rational response to the existing situation (pp. 6, 10f., 12, 24, 56); that, in fact, the statistical evidence presented—for example, that which shows that an extension of plant often occurs after prices have begun to weaken, and that the extension of plant is followed by an increase in the output of finished product (pp. 14ff., 43ff.)—"proves" that both the price-system and the entrepreneurial activity based upon it are a snare and a delusion.

Yet why, for example, should the expansion of plant in the face of a tendency of prices to decline always be regarded as evidence of irrationality on the part of entrepreneurs? If the new plant is of a *different sort* from that in existence, its construction may be perfectly consistent with declining prices in every case in which the new plant makes it possible to produce at *lower costs*. To talk of the construction of plant as being "excessive" under such conditions is to avoid the whole complex of problems associated with the facts of economic progress.

Similarly, an increase in the production of finished goods after the production of plant has begun to decline is in itself no proof of irrationality on the part of entrepreneurs. Some time-lag is inevitable as a result of the fact that machines must be produced before they themselves produce; and no one familiar with the consequences of the durability of the machine in a society evidencing changes in the rate of growth—consequences the theoretical development of which in this country is associated with the name of J. M. Clark—will be prepared to admit that the mere fact of a diversity in the amplitude of the output-curves for machines and finished products necessarily shows irrationality on the part of the producers involved. Finally, although under certain circumstances the reasons why production increases when prices are weakening may be those given by the author—for example, a desire to make up in volume of sales for the loss per sale unit, with a resulting worsening of the general situation (pp. 5, 13, 18f., 27, 64)—it may also be true that the lowering of prices may itself be the factor which provides a rational basis for the increase in production, in that the lowered price may result in an extension of demand.

It is to be feared also that the same fatal looseness which is associated with the concept of "capacity to produce" characterizes the author's "normal capacity of consumption" (pp. 5, 10, 18, 20ff., *et passim*). The author himself is abundantly aware of the looseness of this concept (pp. 21, 70ff., 74); and, in practice, his measure for the curve of "normal consumption" turns out to be nothing more than a parabolic trend fitted to the data for "capacity to produce" (pp. 21, 63, 72, 74), the suggestion being that such a trend may be taken to represent the course that "production capacity ought to have followed in order to adapt itself better to consumption capacity." The author suggests, indeed, that the point of intersection of the interpolated parabola with the curve of original data may be interpreted as representing the point at which "capacity to produce" begins to outstrip the "normal

capacity to consume" and hence provides a basis for forecast and ultimately of control (pp. 36, 63, 74).

Yet it must be obvious, in the first place, that until an independent economic meaning can be given to this interpolated parabola, by methods at which the author only hints (pp. 21f., 75ff.), its relationship to something properly called "normal capacity to consume" is highly problematical. It should also be obvious that, quite apart from the ordinary objections to reliance upon the continuance of "trends" for forecasting purposes, there are very grave reasons—grave despite the summary dismissal of some of the relevant issues by the author (p. 14; cf. also p. 71), and deriving from some of the most fundamental questions that have been raised with respect to the theory of the cycle—for asking whether the elimination of the movements about the trend can be eliminated without eliminating, or at any rate greatly modifying, the trend itself. The net effect, obviously, of these and other considerations, is to leave one wondering what remains of the concept of "normal capacity to consume," as it appears in the monograph under review.

It is hardly necessary to comment here at length upon the author's expressed belief in the promise of the "Corporative State" for the correction of the weaknesses of "free enterprise" (pp. 66ff.), in view of the fact that the author himself admits that state "control" in general has not had a particularly glorious record (p. 67), that at best serious difficulties of an international character stand in the way of "control" along the lines desiderated by the author (pp. 68, 79f.), and that no factual evidence is presented in support of the claim that "the Fascist regime has already obtained brilliant results in this field" (p. 67).

ARTHUR W. MARGET

University of Minnesota

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*Industrial Germany,* by Herman Levy. Cambridge: The University Press; New York: The Macmillan Company. 1935. x, 245 pp. $3.50.

The United States has just completed its first experience with a deliberate attempt toward government control of industrial combinations. With the invalidation of the National Industrial Recovery Act in its initial form, the problem has by no means disappeared; it has become only the more acute. The drive of private entrepreneurs toward legal concerted action, on the one hand, and public opinion against monopolies and their effect on the consumer, on the other hand, will, no doubt, force Congress to legislate again in the not too distant future. The experiment with the National Industrial Recovery Act was too novel, and the time allowed it too short, for much conclusive experience to guide future legislation. Keen interest in experience in this field in foreign countries will thus continue. Any publication from abroad touching upon this problem will be scrutinized to discover whether it may be a contribution toward solving these questions here. Particularly important are studies on the economic effects of monopolization,

on their effects on cost of production and prices, and studies of experience with governmental control of monopolies. The highly significant problem of whether such control can ever be efficient and on what basis it can act, particularly in supervising prices, is of utmost importance. From all these points of view, the present book will not be a great help. The attitude of the State toward cartels in Germany is not elaborated to any great extent. Germany was the first country to enact a law for supervision and partial control of industrial combinations. A detailed and critical analysis of its efficiency would have been of real interest. Furthermore, the chapters on the effects of industrial combinations on costs and prices lack theoretical thoroughness. The relationship between cartels and the business cycle, their significance for greater economic stability, and their often alleged tendencies toward the development of over-capacity in industrial enterprises are scarcely discussed.

The author seems to imply that industrial combinations in the form of European cartels, American trusts, or some other form of association are an inevitable stage in the development of our economic system. I do not feel in full agrement with the author's not entirely clear, and not quite exhaustive, statement on the reasons for and main causes of this development; serious attention should be paid, for instance, to the large increase of fixed capital in many industrial enterprises. I believe, however, that his thesis cannot be disputed. Particularly in view of this fundamental position, the relationship between monopolies and the State might have been dealt with more thoroughly. This problem has played so large and so powerful a role in the industrial and political life of Germany, at least for the last three or four decades, that it would have been of real significance if an expert so familiar with these matters as the author had given us his views more exhaustively and concisely.

Half of the book is devoted to a careful and detailed description of the development and the present state of cartelization in important German industries (mining, iron and steel, chemical and allied industries, electrical engineering and electricity) and in the international sphere as far as Germany's participation is involved. Through many parts of the book, the German development is described against the background of British experience, which the author was among the very first to study many years ago. Although many of the author's remarks (with which I cannot always agree) are interesting and shed some new light on the national differences of industrial development, the book might have profited if the German-British disparity had been dealt with in one chapter and the other chapters had been confined to the main issues to which they are devoted. The legal institutions of the two countries are often referred to, and their significance for industrial combinations shown; I doubt, however, whether legislation can influence lastingly such powerful forces as those leading to industrial combination and whether it does not affect, to a large extent, only the outward appearance of

industrial organization. The example of the United States should be very enlightening in this respect.

The title of the book is, as the author himself intimates in his preface, somewhat misleading. Only one, although an important, element of industrial Germany is discussed, whereas the title would lead one to expect a full story of German industrial life.

OTTO NATHAN

New York University

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*Monetary Policy and Economic Stabilisation,* a Study of the Gold Standard, by Arthur D. Gayer. New York: The Macmillan Company. 1935. xiii, 273 pp. $3.00.

The initial premise of the author is the familiar contention that "There is a logical conflict between the gold standard and domestic monetary stability. The former imposes external control; the latter must, in many circumstances, insist upon internal control." The adverse consequences of this inconsistency have been intensified, moreover, in recent years by the general refusal of erstwhile members of the gold standard world to observe the "rules of the game." Although the author does not deny the advantages of external, i.e., exchange, stability, he does question whether it will prove feasible for nations to make the sacrifices which would be involved in an attempt to reenthrone gold. Possibly the requirements of internal stability could be reasonably well assured under a gold accord between the United States and "sterling area." But the author is not highly sanguine over the prospects of reaching such an accord, and so he is led to contemplate with frankness a situation in which nations would operate their own individual paper currency systems.

Such paper systems are not regarded by the author with as much apprehension as has been customary among orthodox monetary theorists. It is true, he contends, that such systems would have to be managed from the point of view of stability of each country's individual price structure. Conservative management of paper systems, however, is by no means beyond the scope of practical application, and moreover, paper systems would give ample opportunity for the recognition by each country of its own peculiar requirements. The United States, for instance, might fare better by making some concessions to the precepts of "neutral money" doctrines. In Britain, however, where wage systems are more rigid and other conditions less flexible, it is argued that advantage would seem to lie in stabilizing some form of the general price level.

In developing these conclusions, the author digresses with charm into a number of interesting discussions of current monetary problems, such as the merits of the "gold-shortage" theory of the recent deflation, the adequacy of the world's future gold production, the capital inflation in the United

States in the decade of the twenties, and the various guides to monetary and credit policy.

Space does not permit the reviewer to indicate the extent to which he would recommend agreement with the author's main theses. The reviewer must confess, however, that he is becoming somewhat bored by the blitheness with which various writers assume the absolute irreconcilability under an international standard of domestic and external requirements. If such premise is to be lightly accepted as basic, must we not register discontent with any attempt to establish a common monetary system over as broad an area as that governed by many nations? Would not such teachings require, for instance, that the United States be broken up into a number of monetary districts, so that each district could provide the kind of a currency system best adapted to its own requirements? To what extent should this splitting up of areas for currency purposes proceed? Does the refusal of a creditor nation to buy create any different consequences than proceed from similar action by wealthy individuals within a country? Are shifts of liquid capital from, say, New York to Paris, any more disturbing than similar movements from St. Louis to New York? Doubtless the author could shed light on such problems. If so, his discussion might begin at this point and thus spare the reader the pains of enduring once more the repetition of a truism, the pertinency of which has not been clearly defined.

The reviewer is inclined, furthermore, to believe that there is some logical error in most current discussions of the necessary "rules of the gold standard game." Of course the gold standard cannot be maintained if nations will not do certain things. But the gold standard does reveal with clearness when these things are not being done; and one wonders what success could be had with irredeemable paper systems if no attempts were made to check the developments which caused the breakdown of the gold standard.

Something is lacking in current analyses of the gold problem, and the public has not yet been provided with as discriminating a treatment as the subject requires.

HAROLD L. REED

Cornell University

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*The Security Markets*, an Investigation of the Role of the Security Markets in American Economic Life, by Twentieth Century Fund, Inc. 1935. xxi, 865 pages. $5.00.

The paucity of analytical and critical studies of the security markets has been noted by a number of recent writers. Many monographs of a descriptive or an apologetic character are available, but until the deflation period the number of more objective attempts to understand and appraise the workings of the stock exchanges were few and far between.

It is shrewdly stated in this volume that interest in reforming the security markets tends to become keen when quotations decline or when exposés of

particular examples of doubtful or fraudulent practices are made public. The period from 1929 to 1933 met both prerequisites. The result was an unprecedented popular demand that "something be done," culminating in the enactment of the Federal Securities Act of 1933, applicable to new issues of securities, and the Securities Exchange Act of 1934, which is applicable to securities already issued.

Cognizant of this demand for security market reform, the Twentieth Century Fund launched an extensive investigation of the role of the security markets in American economic life. A brief summary of its findings and recommendations was published under the title of *Stock Market Control* in February, 1934. The present volume presents at far greater length the findings of the economists employed by the Fund to prosecute its study.

The second chapter, written by N. R. Danielian, lays down as the three fundamental functions of an ideal stock exchange:

1. Accurate appraisal of investment values, based on present and prospective earning power capitalized at a "natural" rate of interest.
2. A continuous market.
3. Facilitating the flow of the nation's capital into various channels in order to obtain the most productive results.

The bulk of the book is devoted to an appraisal of the extent to which the security markets actually do these things. A number of chapters, however, are almost entirely descriptive. They are more reminiscent of the conventional studies of the past than the more critical and objective work which is promised in the initial chapters. Certain of the chapters in Part III, on "The Organization and Operation of the Security Markets," and in Part IV, on "Informing the Investor," present in convenient form material on the security markets which has not hitherto been available within the covers of a single volume. Also, sound critical discussions of the economic effects of speculation appear in several chapters.

In the light of the named objectives of an ideal market, Chapter VII, on the "Security Markets and Business," is of basic importance. Quantitative studies are here presented of price-earnings ratios of a number of stocks over a period of years, and of groups of stocks. The study, however, is more largely concerned with the qualities of the stock market as a barometer of forthcoming business and earnings changes, rather than with the accuracy with which the market appraises values or the extent to which it directs capital to its most productive uses.

Chapter XVII, on "Conclusions and Recommendations," as one so often finds to be true, shows only an imperfect connection with the inductive material which comes before. It is held proved that the security markets now perform the three basic functions set for them with a marked degree of efficiency, but at "too high a price." Some of the recommendations for reforms go far beyond anything yet provided by Federal regulation, including Federal regulation of the over-the-counter markets, Federal incorporation of all corporations doing an interstate business, uniform state incorporation

laws, separation of commission brokerage business from that of dealing in securities, control of the volume of short selling in any one issue in any trading session, state licensing of investment counsel, and extension of the Securities Act to embrace the publication of financial news.

The Twentieth Century Fund is to be commended for making public these studies, many of them original, of various aspects of the operation of the security markets. The volume suffers, however, from the lack of a single consistent viewpoint. Thus, we are constantly reminded throughout the volume how excessive speculation distorts markets, and yet we are flatly assured on page 63 that "security exchanges are market places where the millions of individual and institutional buyers and owners of listed securities may readily and promptly exchange their savings for stocks and bonds, etc."

In this reviewer's opinion, the chief weakness in this study is the failure to integrate the theory of the regulation of security exchanges with that of credit control. Wilford J. Eiteman has a chapter on "Brokers' Loans and the Absorption of Credit," which repeats his able proof of Cassel's theory that the security markets do not absorb credit but merely furnish an alternative channel through which credit expansion and velocity may stimulate business activity. But no attempt is made to go further and to explain both business and stock market fluctuations since the War as largely a result of the disorder in the nation's credit system engendered by an excess of gold, a failure of the international credit machinery to function properly and, more recently, the use of a huge budget deficit to "reflate" bank deposits through selling large amounts of Government securities to commercial institutions.

JULES I. BOGEN

New York University
The Journal of Commerce

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*Internal Migration in the United States,* by C. Warren Thornthwaite. Philadelphia: University of Pennsylvania Press, 1934. x, 52 pages, 9 plates, and 4 charts. $1.00.

This bulletin is the first of a series in the study of population redistribution undertaken by the Industrial Research Department of the Wharton School of Finance and Commerce. Other bulletins of the series which have since been published are: *Migration and Planes of Living* and *Is Industry Decentralizing?*

The present bulletin is a factual report based on a careful analysis of Census data on states of birth and age distribution of the population, vital statistics reports, and certain economic data related to migration. The author attempts mainly to show the extent and general character of internal migration in the United States from 1870 to 1933. Very little space is given to

relationships between migration and other economic processes, although there are many brief suggestions and a few tables and charts showing such relationships.

Distinctive contributions of this bulletin are: (1) the two-color maps showing extent and direction of interstate migration, and (2) the critical appraisal of various techniques and methods of measuring migration from materials originally collected for other purposes. It should be said, however, that the Division of Farm Population and Rural Life of the Department of Agriculture have had available for several years maps in black and white showing migration trends within the United States from 1870 to the present. Mr. Thornthwaite's most original contribution is Plate V, which shows the movement of population by means of *arrow-bands* whose width varies in proportion to the volume of migration from state to state. The general effect is that of a stream of migrants moving from east to west, being fed by tributaries from each state. It is also designed to show the amount of population stopping off in each state as the great stream moves westward. I presume that the next great contribution in this field will be an animated chart, prepared in cooperation with a motion picture studio, which will show in one brief film the entire history of migration in the United States.

In spite of the fine contribution which this bulletin makes to migration studies, it is unfortunately lacking in detailed analysis of relationships, or what might be called, for want of better terms, the causes and effects of internal migration. The author merely opens up this phase of the subject and whets the appetite of the student for more. His analysis of population changes in Oklahoma is, however, quite *apropos*.

The author makes little or no reference to the part which natural increase rates play in rural-urban migration. There is unquestionably heavier migration from areas of high natural increase than from areas of low natural increase; but the relative importance of this factor has never been adequately analyzed.

It should be said that bulletins two and three of this series present more adequate treatment of the *cause-effect* relationships involved in interstate migration.

C. Horace Hamilton

University of North Carolina

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*Regulation of the Small Loan Business,* by Louis N. Robinson and Rolf Nugent. New York: Russell Sage Foundation. 1935. 271 pp. $3.00.

This work, offered as a summary of previous volumes in the Russell Sage Foundation Small Loan Series, is much more than that. It is a rounded presentation of the problem with all essential factors considered in relation to an enlightened social policy. None of our perennial proposers of unsound small loan laws can be excused for his ignorance when the truth is at hand in this plain, adequate, authoritative volume.

There are many concrete details. In the history which occupies the first half of the book, we learn that Babylonians exacted high interest as early as 4000 B. C.; that a delinquent Roman borrower might pay his overdue debt with his life; that in 1515 the Pope sanctioned interest-taking; that about 1870 chattel and salary-lending first appeared in this country. Among such details as these the great usury cycle stands out clearly: early temporal and canon-law limitations on the taking of interest as a protection for the necessitous small borrower; gradual relaxation of legal restrictions, as the growth of commerce demonstrated a productive use for borrowed capital; monopoly by business of available loan funds, to the exclusion of consumers; and, finally, increased need for consumer protection, as capital became more plentiful, and the small individual lender, deprived of his commercial business by banks, turned once more to necessitous borrowers.

We are prone to think that the small loan business would have thrived long ago, were it not for prohibitory laws and censorious public attitudes. Robinson and Nugent dispose of that notion. They show that, although wise laws have helped to raise the business to a higher ethical plane, the laws have not created the business. The main factor has been a change in the economic condition of consumers. From self-sufficient farmers with small, uncertain cash incomes, a majority of consumers have become urban dwellers dependent on relatively large cash wages. As the consumer's standard of living has improved, so has his status as a credit risk. Commercial lenders took account of that fact several decades in advance of legislatures. By the time Massachusetts enacted the first weak small loan statute in 1888, an illegal small loan business was well under way, and by the time the Uniform Small Loan Law was framed a quarter of a century later illegal lenders flourished in every industrial city.

The first inroads on the business of rapacious lenders were made not by legislation but by remedial loan societies. Operating with funds provided by charitable well-wishers, these societies proved the effectiveness of legalized competition. When, in 1910, their national association joined forces with the Russell Sage Foundation to fight for adequate small loan laws, the modern small loan era began.

How successful the fight for permissive legislation was, is shown in the authors' penetrating analysis of the changes which the small loan laws have brought about. Formerly, illegal lenders operated from small, hide-away offices, with loan balances averaging $10,000 per office for chattel lenders, and less for salary lenders. Today, offices with balances in excess of $100,000 are in the majority, and the $10,000 office is a rarity. Formerly, wage assignment and unsecured notes were most common; now chattel mortgages and endorsed notes predominate. Moreover, the average size and average term of loans has increased markedly, and capital is now obtained in the market place at low rates. Every change has favored economy and efficiency.

Without these changes, the small borrower would be only moderately better off than before; for, although unregulated rates of 10 per cent to 50 per

cent a month permitted extremely high profits, costs of operation were also extremely high. It is from changes in methods of operation, as much as from the reduction of profits, that the borrower has gained relief.

The chapter on maximum rates should be helpful to states which are contemplating a change of rate. Drawing from the experience of states which have permitted monthly charges of 1, 1½, 2, 2½, 3, and 3½ per cent, and combinations of these rates, the authors show just what is likely to happen under each schedule. In order to cut off a given class of borrowers from legal loan services, all the legislators need do is to take into consideration the degree of industrial development of their state and set a maximum rate. Once the social policy has been determined, the appropriate rate follows. The difficulty is to get legislators to pay any attention to the facts.

Particularly is this condition true in states that have no effective small loan law. If the facts were known, opinion would force a change; no longer would needy borrowers be forced to pay 20 per cent or more a month simply because uninformed legislators think that 3 per cent a month is too high for any loans whatever.

The foreword states that this volume is the final one of the Russell Sage Foundation's Small Loan Series, which was initiated in 1924 with *The Regulation of Pawnbroking* and continued on through *Ten Thousand Small Loans* in 1930, *Small Loan Legislation* in 1932, *and Moneylending in Great Britain* in 1933. This suggestion of finality is our main objection to the new volume. The small loan business emphatically has not reached a condition of stability. Only half the states have satisfactory loan laws. Some of those which have enjoyed tolerable conditions for some years are now backsliding. The people generally do not yet understand the necessity of seemingly high rates for consumer credit, and opportunist politicians know it. The need for dispassionate, unbiased factual studies and for socially minded criticism and sponsorship is nearly as great as ever. It is to be hoped that the current series has been terminated only in order that a new series may be started.

LeBaron R. Foster

Pollak Foundation for Economic Research

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*Corporate Profits as Shown by Audit Reports,* by W. A. Paton. New York: National Bureau of Economic Research (Publication No. 28). 1935. 151 pp. $1.25.

How profitable are business enterprises? What are their rates of profits? What are the characteristic differences in profit rates among individual concerns and among different industries, and how can these differences be explained? These are questions which have always been asked, but until quite recently very little has existed in the way of concrete evidence sufficient to afford any empirical basis for answering them. Professor Paton's study is welcome, therefore, as an additional entering wedge into a field in need of extensive investigation.

The information which Professor Paton presents in this volume is based upon the income-sheet and balance-sheet statistics of 714 corporations for the years 1927, 1928, and 1929. These reports were obtained for the National Bureau of Economic Research by the American Institute of Accountants from the files of their members. In general, the concerns covered by the reports may be described as small and medium-sized corporations. The same concerns are included in all three years so that the effect on profits of new entrants and of failing concerns is not included. Furthermore, it was not possible to consider the extent to which the age of the concerns influenced their earnings ratios.

The study considers profits from the standpoint of both earnings on the total capital and earnings on stockholders' equities. In addition, attention is given to the effect upon profits of (1) preference stocks, (2) size of enterprise, (3) common dividend policies and surplus accumulations, and (4) certain other financial and operating characteristics such as ownership ratios, liability ratios, operating ratios, and so forth. Since it was possible to compute earnings ratios for each concern, the author presents both simple and weighted average rates of earnings for the major and minor industrial group contained in the sample.

The extension of the findings on average rates of earnings is severely restricted by the size of the sample. In general, however, the findings agree fairly well with the results derived from larger samples and indicate once more that large profit rates are not representative of industrial endeavor. The *usual* rate in most industrial classes is seldom large. (See figure 2, page 59, where the modal rate of profit on both total capital and stockholders' equities is approximately 5 per cent.) Surprisingly enough, modal rates are not mentioned by Professor Paton, and only simple and weighted mean averages are cited. Such averages are, of course, significantly greater than the modal rates. The mean average rate in trading is found to be lower than in manufacturing. This result is the reverse of Epstein's findings, but in line with the evidence based upon data published in *Statistics of Income* for 1927, 1928, and 1929 for 90,000 trading and 125,000 manufacturing corporations. Undoubtedly these differences are due to sample content and can have only limited significance until the specific aspects differentiating the samples have been brought to light.

The findings concerning size and earning power are not at all positive, although there is some evidence that the size group which includes firms with assets between $50,000 and $200,000 earned higher rates on total assets during 1927–29 than did smaller or larger corporations. If large concerns have any ascendancy in earning power, it seems to be among the trading corporations, whereas the small concerns seem to fare better in manufacturing. More definite conclusions in this respect must await finer breakdowns of industrial groups. When such breakdowns are possible, it will probably be discovered that factors other than size are responsible. In some instances, these other factors will be correlated with size but in other instances they will not be

so correlated. Thus size alone cannot be associated either positively or negatively with earning power.

The discussion of the need for further analysis of accounting records, which is the subject of the concluding chapter, helps to temper the disappointment that the reader will feel when he discovers the small amount of space that is given to the analysis of accounting procedure and the process by which the basic data on earnings and assets are furnished. Until accounting procedure within and between industries is more completely elucidated, until we know and can take account of the different ways such procedures are affected by changing industrial conditions, we must accept such ratio findings as these, because no others which allow us even a modicum of insight are available.

RAYMOND T. BOWMAN

University of Pennsylvania

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*The Taxation of Banks.* New York: National Industrial Conference Board, Inc. 1934. x, 148 pp. $2.50.

During the past 15 years, state taxation of banks in the United States has been marked by numerous changes in methods, widespread litigation, and much controversy in general. This general state of flux has been nurtured by the tendency of states to shift from the general property tax to classified property taxes with low rates on intangibles; by the fact that numerous court decisions have held that for a state to continue to tax national bank shares at the general property rate while levying only a low millage rate on competing "moneyed capital" is in contravention of the Federal statute which protects national banks against discriminatory state taxation; by revisions of the Federal law to permit national banks to be taxed on or according to net income; and by revisions of state bank tax statutes in the light of the decisions of the courts and changes in the Federal restrictive statute.

The book under review is a study of bank taxation (including Federal as well as state methods) in this period of controversy and change. Following a brief introduction in Chapter 1, the study is begun in Chapter 2 with a survey of the major trends in bank taxation from 1921 to 1934: (1) from the property tax on share value to taxes on or measured by net income; (2) from general property tax rates on share value to low millage rates; and (3) from a broader to a more restricted base for the levy of the general property tax on bank shares. The "reasons for the substitution of one principal method of bank taxation for another are set forth and analyzed," by states, in Chapter 3. States covered include Massachusetts, New York, Wisconsin, California, Oregon, Utah, Idaho, Oklahoma, Alabama, Kentucky, New Hampshire, Nebraska, South Dakota, Kansas, Ohio, Florida, and Vermont. The study is continued, in Chapter 4, with an analysis of the significance of taxation as a factor in banking operations. A number of ratio analyses are used to establish the fact that marked differences in the burden

of bank taxes are caused by different methods of taxation. Chapter 5 consists of a discussion of the shifting and incidence of bank taxes. In Chapter 6, the author estimates, by means of both inductive and deductive analysis, the effects of bank taxation policy on the ratio of bank capital to deposit liabilities, and the influence of taxation on bank operations and functions. The final chapter comprises a brief summary of the more detailed studies in the preceding chapters and a number of conclusions drawn from them.

This book should be of interest to bankers, tax officials, bank supervisory authorities, and others who have an interest in taxation or banking. Numerous tables provide summaries of information relative to the varied aspects and effects of bank taxation. The study is clearly outlined and carefully carried out. In the writer's opinion, however, its value could have been somewhat enhanced by the inclusion of a bibliography, an index, and a brief résumé, at the beginning of Chapter 1, of the historical and constitutional background of the Federal statute restricting state taxation of national banks.

THOMAS J. ANDERSON, JR.

New York University

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*The Design of Experiments*, by R. A. Fisher. Edinburgh: Oliver and Boyd. 1935. xi, 252 pp. 12 s. 6 d.

Even statisticians who understand the importance of sampling errors are inclined to collect data first, leaving the study of tests of significance in terms of probability as an afterthought. The like is true of experimenters. But if a careful study of sampling errors is made before the collection of data or the laying down of the experiment, it is generally possible to adjust the technique so as to bring about enormous economies, with increased accuracy of the results. It is not at all uncommon to find one part of a research appropriation expended to obtain a number of cases greatly in excess of those needed, while another part of the same appropriation is left too small to make possible the collection of enough cases within its purview to provide an adequate basis of comparison. In general there is an optimum mode of distributing a limited fund among the parts of an investigation in order to provide the most sensitive possible test of any particular hypothesis; the determination of this optimum is a problem involving sampling errors.

Professor Fisher, whose work on sampling distributions has been of the highest importance, now contributes a work on the efficient design of experiments. The principles involved in the agricultural experimentation which supplies his chief illustrations are also applicable to a variety of inquiries in the domain of the social sciences, though these sciences are scarcely mentioned in the book. One thinks of questionnaire investigations, tests by means of keyed advertising, estimates of production and prices based on selected samples, mental testing programs, and efficiency studies. Economic experimentation on a grand scale has recently been espoused in the highest official quarters,

but evidently without knowledge of the principles that must be observed if an experiment is to yield information.

After a convincing account of his theory of inductive inference, the author illustrates a sequence of situations of increasing complexity in which hypotheses can be tested efficiently by means of experiments of suitable design, or inefficiently by such experiments as might first occur to one. The simplest of these relates to a lady's claim that she can tell by taste whether tea or milk has been put into the cup first. The necessity of an element of randomness in the arrangement is made clear.

The chapter on Latin and Graeco-Latin square designs is of great interest. If differences of yield are to be investigated among varieties A, B, C, and D of potatoes, a field may be divided into four rows and four columns. A Latin square arrangement is one in which no two plots in the same row or the same column contain the same variety. An efficient design for this experiment would involve a random choice among the 576 possible 4 x 4 Latin squares. But at the same time, on the same ground, another experiment can be carried out, for example, to determine the relative efficacies of four different fertilizers. Even a third experiment, for example on the effects of different methods of cultivation, can be applied simultaneously. If an appropriate Graeco-Latin square is used, these three experiments do not at all interfere with one another. Indeed, at almost no increase of cost over one of them alone, they give much more information than if all three were to be carried out separately, for the simultaneous experiment throws light on the interactions, or non-linear combinations of effects. The results are also better than those from separate experiments in providing a basis for inductive inferences applicable under a wider class of circumstances. The chapter closes with a logical puzzle reminiscent of the riddles of Lewis Carroll.

Stress is laid on denial of the common belief that in an ideal experiment only one factor is varied at a time, all others being held constant. The chapters on Confounding develop a highly ingenious idea. Increasing the size of a sample in order to diminish standard errors often fails because of the necessity of including heterogeneous material. To avoid this, it is sometimes possible through careful planning to gain the necessary precision by suitable layout of the experiment without increasing the number of cases, but at the sacrifice of knowledge of the more complicated interactions among factors.

A review of one of Darwin's experiments and the calculations he made from it in accordance with Galton's suggestions shows the crudeness of the statistical methods then in vogue. This historic example should be a warning to those who today manipulate data without regard to the theory of probability. The book closes with chapters on the increase of precision by means of corrections involving concomitant measures and regression equations, on fiducial probability, and on the measurement of amount of information, all of which will repay careful study. The exposition is almost completely non-mathematical, though a little calculus is used in the last chapter.

HAROLD HOTELLING

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*Practical Applications of the Punched Card Method in Colleges and Universities.* (Edited by G. W. Baehne.) New York: Columbia University Press. 1935. xxii, 436 pp. $4.50.

In the application of the punched card method to any problem, a wide variation in technique is possible. There are many possible variations in the method of coding, in the design and arrangement of the punched card, in the use of the various hand-operated and automatic punches in transcribing the data to the cards, and in the use of the various types of equipment in sorting and tabulating the data. The most obvious method may not prove to be the most economical. A familiarity with the procedure used on other projects is essential to an understanding of methods which have proved to be practical and is of great value in selecting methods suitable for a particular project. This book affords an opportunity to examine the methods used in 38 applications of the punched card method. It is an excellent volume and should be in the hands of all persons using or considering the use of punched card equipment.

The book is divided into 39 sections. The first section presents a short history of the punched card method perfected by Doctor Herman Hollerith and traces its development from its first major installation in tabulating the Population Census of the United States in 1890 through the various improvements in the method down to the present time. A brief explanation of the operating principle of the Hollerith type of punched card equipment is given, as well as illustrations of the various types of equipment and an explanation of the functions which they perform.

Thirty-six of the sections present different applications of punched card methods in colleges and universities. Each of these sections was prepared by a person closely associated with the particular application. These 36 sections are grouped according to the field of application, as follows: registrar's office, university business office, miscellaneous administrative applications, psychological and educational research, medical research and hospitals, legal research, agricultural research, and miscellaneous research. The two remaining sections present applications of the punched card method to the problem of obtaining the moments and product moments required in multiple correlation, in analysis of variance, and in curve fitting.

There is considerable variation in the approach of the several authors. Some of the sections are devoted primarily to the design of the punched cards and to the coding of the data; some stress the tabulation method employed; and others place greatest emphasis on the results obtained from the analysis. More than 60 punched cards and the same number of tabulation result sheets are illustrated in the volume. There are also a number of special codes and examples of schedules and questionnaires on which the method has been applied, together with some tables and charts derived from the analyses.

The book was edited by Mr. G. W. Baehne, who is in charge of the Institu-

tional Department, Tabulating Machine Division, International Business Machines Corporation, and all the applications presented in the book are made with the equipment produced by the company with which he is associated. Although it does not necessarily detract from the value of the book, it is apparent that only successful installations are presented.

Although the punched card method is undoubtedly useful in the large-scale analysis of data which are readily reducible to numerical quantities or codes, it should not be assumed that it will be the most economical method on every project. The authors fail to point out the following limitations in the use of this method: (1) It is necessary to reduce most of the data to codes or quantitative numbers. Although the alphabetic punch does reduce this necessity in some cases, with the punched card method it still is desirable to reduce most of the data to the form of code numbers. (2) In addition to the editing of data, which is necessary under any system of tabulation, it is necessary to code items, check coding, punch the cards, and check punching. When a particular card presents data which appear questionable, it is necessary to refer back to the original schedule to recheck the entries. All these hand operations are necessitated by the use of the punched card method and detract from the final efficiency of its use. (3) Although this method is often economical when many different cross classifications and correlations of the same data are required, there are many cases in which the required tabulations are very simple and the results may be obtained more rapidly by less devious methods. (4) For any analysis it is necessary to develop the codes, code the data, check the coding, punch the data on cards, check the punching, design the proper sorting and tabulating arrangements and carry through these procedures, and transcribe the records from the tabulation sheets to the final tables. When only several hundred schedules are included in an analysis, the work involved in these operations might exceed the labor required to carry through the tabulation by hand methods. (5) Although there are a great many fields in any university in which the punched card method may be used to advantage, the required equipment is expensive to install and maintain, and a very large volume of work is required before the expense of installation is justified.

There is no intent here to question the efficiency of the equipment when suited to the problem at hand. For example, in an application of the punched card method to the analysis of intelligence tests, Doctor H. A. Toops found that the daily output of a counting-sorting-printer of 3 rolls was equivalent to that of a clerk making tally marks in tables for 2 years.

The material in the book is well organized and will be of value to those interested in the application of punched card methods in other fields as well as in universities.

HOWARD G. BRUNSMAN

Federal Housing Administration

*Reporting of Industrial Statistics*—Report of the Committee on Statistical Reporting and Uniform Accounting for Industry to the Business Advisory and Planning Council for the Department of Commerce. Business Advisory Council, Department of Commerce, Washington, D. C. Free.

This report was prepared by a Committee consisting of Walter S. Gifford, Chairman, Pierre S. du Pont, and W. A. Harriman, with Donald R. Belcher as Executive Secretary. The report has been confined strictly to the limitations imposed by its title and thus does not deal with the question of the uses to be made of the data after they are collected and published. Furthermore, the report, rather than making a presentation of a broad program of governmental statistical activity, is concerned almost entirely with the activities of the Department of Commerce in the field of industrial statistics.

The Committee offers a strong endorsement of the general census studies of industrial activity on an annual or biennial basis and recommends that these be broadened as much as possible. Beyond that, however, its main recommendation is that the Department of Commerce encourage the gathering and tabulation of current data by the trade associations in their respective fields, confining itself to the publication of only such totals and averages of these facts as may be of broad public interest.

There can be no argument on the soundness of the Committee's appraisal of the place of the trade association in any comprehensive program of industrial statistics. The trade association is composed of, and supported by, the members of the industry and will have far less difficulty in obtaining comprehensive data voluntarily than will any Government agency. Furthermore, every industry interested in a statistical program at all will want much more detailed figures than would be advisable for a Government agency to collect as a regular activity. Even though the Government agency were to collect the data in the detail desired by the industries, the burden of such an undertaking on a centralized basis is impossible to conceive, if the reports are to be promptly summarized and distributed.

There is violent opposition in some quarters to this plan, on the grounds that associations are poor custodians of confidential data; that they seldom appreciate the need of having trained statisticians; that their tenure is often highly uncertain; and there are numerous other objections. But in any industry in which the members are not sufficiently alive to their own needs for a good statistical program, the substitution of a Government agency, although it may produce more and better data, will not compel their use in better management of the industry, and thus the data will only be of historic interest to a few students. On the other hand, many associations have long since proved the merit of industry statistical programs, for example, the machine tool, rubber, automobile, and paper industries, to mention only a few noteworthy instances. No Government agency could begin to perform the statistical services which the associations in these industries are now fulfilling.

It is unfortunate that the committee which prepared this report failed to explore this issue exhaustively. Possibly the answer is to have certain compulsory reporting to the Government, but to underwrite this function to the associations which can satisfy the Census Bureau and the Central Statistical Board that they are adequately equipped to perform it. In this way both the industry statistics movement and a sounder, less ballyhoo-type of trade association program would be accelerated, and at the same time the work would be decentralized and conducted by those directly in touch with their own peculiar problems.

There is one astonishing comment by the Committee which cannot go unchallenged. The Committee does not recommend obtaining data on orders, stating that "orders, new and unfilled, have not been included for the reason that their usefulness to others than members of the particular industry would appear to be generally slight and their forecasting property of doubtful significance"! That statement, in a system in which the immediate cause of current fluctuations in the level of business activity is a change in the rate of business buying, is astonishing. The explanation may lie in the dominating public utility background of the members of the Committee. All industrial statisticians and managers who have been interested in this problem will unanimously agree that the compilation of data on production, stocks, and shipments only is of small value in comparison with these series accompanied by data on new and unfilled orders. Without all five of these series, the problem of rational industrial control is infinitely more complex and unsatisfactory. With all these series available, this reviewer can speak from personal experience on their value in forecasting both price and production in at least two industries, namely, merchant pig iron and fire-clay brick. The automobile industry's whole technique of production control is based on the estimated rate of retail buying corrected as the actual sales are reported at least every ten days. Only when orders and shipments are synonymous, as in retailing, is the position of the Committee tenable that only data on production, shipments, and stocks are necessary.

The Committee should be given a great deal of credit for the manner in which it has compiled a catalogue of the desirable series to be obtained, with notations concerning those already available and the sources from which they are obtained. This compilation should be of tremendous value to all students of current industrial statistics and will serve as a ready reference for source material in this developing field.

The report as a whole is worth reading by all technicians interested in this field, if only to be acquainted with another of the reports conscientiously prepared by business men who took seriously their job of trying to help the New Deal develop practical programs, only to learn at a later time that those who could do something about their recommendations were too busy even to read or understand them.

S. M. DuBrul

General Motors Corporation

*The Construction of Mortality and Sickness Tables* (Third Edition), by W. Palin Elderton and Richard C. Fippard. London: A. and C. Black, Ltd. 1935. 127 pp. with numerous tables.

It is a compliment to this excellent work that so little revision proved necessary for this, its third edition. The first edition, appearing in 1915, was followed shortly afterward by the second in 1922. For the most part the book is unchanged in this latest edition, although significant alterations have been made in the last chapter devoted to the comparison of various mortality tables for insured lives and annuitants.

The book is intended primarily for the beginner and requires no previous acquaintance with the subject matter. Explanations have been given verbally throughout, and the authors have been careful to avoid mathematical formulae which would confuse the layman and prove of little use to the beginner in the subject. Numerous examples are inserted in each chapter to point out clearly the methods employed.

The first chapter begins with a detailed account of the pitfalls to be avoided in the analysis of mortality statistics. The authors then proceed to discuss in detail the methods employed in the investigation of mortality among insured lives, beginning with a consideration of the data required and the collection of the same and continuing through the calculation of the years of exposure to the final determination of the mortality rate. Separate chapters are given over to consideration of select and aggregate mortality tables. The book continues with a discussion of the methods employed in the analysis of data relating to withdrawal, marriage, and sickness tables. Several chapters are devoted to the construction of tables by the census method. The book concludes with chapters on the methods of comparison of different mortality data and tables.

This book furnishes an excellent non-technical introduction to this subject of mortality and sickness investigations, a field where little printed material is available.

W. O. Menge

University of Michigan

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*Mortality among Patients with Mental Disease,* by Benjamin Malzberg. Utica, New York: State Hospitals Press. 1934. 234 pp.

For many years it has been known that the mortality of the insane is far higher than that of the general population. Many comparisons, however, have been vitiated by neglect of the differences in age distribution between the two populations. In this admirable study, Dr. Malzberg analyzes the data for total mortality and causes of death among all patients with mental disease under treatment in the New York civil state hospitals during the three years from July 1, 1928 to June 30, 1931. The results are presented not only for the total mental hospital population but also separately for

patients with dementia præcox, manic depressive psychoses, psychoses with cerebral arteriosclerosis, general paralysis, and alcoholic psychoses.

The death rate of patients with mental disease aged 15–19 years is found to be 24.3 times the death rate at the same ages among the general population of New York State. With advancing age the ratio decreases, at first rapidly and later more slowly, until at 85 years and over the death rate of the insane is only 1.6 times that of the general population. Between 15 and 30 years of age the patient population shows a decline in death rates, a decline for which there is no counterpart in the general population. In general the death rates are highest in the organic psychoses and lowest in the functional.

It has been customary in discussions of the subject to emphasize the prevalence of tuberculosis among the insane. The leading cause of death at present, however, in the insane as in the general population, is not tuberculosis but diseases of the heart. In the insane population this cause is followed by pneumonia and general paralysis, the latter being an almost negligible disease in the general population. The death rates from general paralysis, however, have shown a gratifying decline since the introduction of malarial therapy.

Although tuberculosis ranks only fourth among causes of death in the total insane population, it leads the list among patients with dementia præcox. Luxenburger has shown that this susceptibility to tuberculosis extends to the non-psychotic siblings of schizophrenics and is therefore probably constitutional.

Cancer, cerebral hemorrhage, nephritis, and diabetes show low death rates among patients with mental disease. Cancer in particular has a lower standardized death rate than among the general population. The causes of this relative immunity are as yet unknown and, as the author suggests, the problem seems to constitute a fruitful field for further research.

Bibliographies to many of the chapters and an index are provided. Altogether, all those interested in public health and mental hygiene and especially the medical staffs of mental hospitals owe a debt of gratitude to Dr. Malzberg for this excellent study.

JOHN R. MINER

The Johns Hopkins University

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*Standard Classified Nomenclature of Disease,* (Compiled by the National Conference on Nomenclature of Disease; edited by H. B. Logie, M.D., C.M., Executive Secretary). New York: The Commonwealth Fund. 1935. xxi, 870 pp. $3.50.

As the representative of the American Statistical Association on the National Conference on Nomenclature of Disease I told, in my "Progress Report" to the Association, at the Washington meeting in December, 1931, about the necessity for a new nomenclature and about the work that was

progressing to that end. This report appears in full in the JOURNAL OF THE AMERICAN STATISTICAL ASSOCIATION, New Series 177 A (Vol. XXII). Since that time a "Preliminary Printing," a First Edition (1933), and a Second Edition (1935) of the Standard Classified Nomenclature of Disease have been published.

The basic reason for the new nomenclature was the recognition of the fact that there was need for a system of classification that was both topographical and etiological, and which, at the same time, would readily lend itself to the needs of hospital record rooms.

Delegates to the National Conference on Nomenclature of Disease were appointed by various associations representing the several branches of specialized medicine; also by representatives of various Government bureaus, the Army, the Navy, and a number of scientific societies. Cooperating committees were named by several of these groups. The work was financed by the Commonwealth Fund, the Metropolitan Life Insurance Company, the Prudential Insurance Company of America, the Connecticut General Life Insurance Company, and various constituent societies of the National Conference. Many distinguished physicians served on committees or as consultants. The major share of the responsibility for completing the work devolved upon the Executive Secretary of the National Conference, Dr. H. B. Logie.

In the preparation of the second edition the various cooperating and advisory committees reviewed the sections of the Nomenclature in which their particular interests lay and made changes which varied from slight alterations to entire rewriting. The principal change was the entire rearrangement of the diseases of the heart.

The distribution of the Nomenclature since the publication of the new edition in January has continued steadily. One hundred and seventy hospitals are now known to be using it; an unknown number of others, mostly small hospitals, are using it in some fashion. In about six hundred hospitals altogether, a copy has been secured by the superintendent, by the record librarian, or by the hospital itself. The most notable new users during the past year have been the Bellevue Hospital, Johns Hopkins Hospital, and the New York Hospital. It is estimated that the total bed capacity of the hospitals known to be using the Nomenclature approaches 50,000. This means that the number of patients whose diseases are being diagnosed according to the new method is not far short of 1,000,000 a year.

The Nomenclature continues to be introduced to some extent in other countries. It is being used, or about to be used, in the School of Tropical Medicine and the University Hospital of Porto Rico; this use will afford a test of its value in the diagnosis of tropical diseases, and the National Conference expects to profit materially by advice received from the physicians there. It is also expected that it will be used in the Government Hospitals in Egypt; this will provide another useful test, particularly in tropical and eastern diseases.

The National Conference continues to maintain its central office, by means of which information is supplied to hospitals using the Nomenclature, and assistance given them with any difficulties which may arise, either with the technique of the record system or with the use of the Nomenclature as a guide to diagnosis in the hospital itself. Upon the exchange of opinion so encouraged are based the changes in and additions to the Nomenclature which are being made in preparation for a subsequent edition, to be published probably about 1940.

GEORGE H. VAN BUREN

Metropolitan Life Insurance Company

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*Forest Mensuration,* by Donald Bruce and F. X. Schumacher. New York: American Forestry Series. McGraw-Hill Book Co., 1935. 354 pp. $3.50.

The forester's search for facts has been getting more intense, and the scope of his problems wider and more complex. Like his colleagues in other fields of applied sciences, he could not escape the growing conviction that he needed some trustworthy methods to guide him in collecting, classifying, and using numerical facts. He is now gradually making the knowledge of the well-known statistical methods a part of his working equipment.

Forest mensuration is as old as forestry itself. It is that branch of forestry whose particular field deals with measurements of sizes of the individual trees or stands, their volume, growth, and development. It is a basis, so to speak, upon which management plans are founded and silvicultural policies are sometimes recommended. It deals, therefore, primarily with measurements. Mathematical concepts of forest mensuration are mostly empirical, requiring constant elucidation through rigorous statistical analyses.

Lately, mensuration has been stagnating. Strongly influenced by old European textbooks at the outset, it gradually fell into a narrow and orthodox path, clutching to a few specific rules and iron-clad formulae as a cure-all for many perplexing problems. A more rational or scientific basis was obviously needed. Only ten years ago the senior author had bitterly remarked that the statistical method was not taught in our forest schools, that it found small place in forestry literature, and that it was little used even in forest research. Today the statistical methods are being more widely used, and the situation is not so gloomy; still, much needs to be done in disseminating knowledge of correct procedures and in cultivating the powers of critical analysis among everyday workers and especially among college students who are choosing forest research as their future profession.

The authors have taken this opportunity to abandon the old treatment of the subject and to substitute in its place a more general one, based on the fundamental concepts and processes of the statistical method in order to stimulate independent thinking and, as they say, "to facilitate the progressive acquisition of the ability to handle the tools of mensuration." They have given a great deal of thought to the systematic solution of many important

problems in forest mensuration. Many of the solutions are entirely original and show considerable preparation. The presentation of the subject is simple and clear. Both writers have had considerable experience in teaching this subject at the University of California. The book was in preparation for many years, having been started by the senior author and later considerably revised by the co-author.

The subject matter is presented in four parts: Part I, consisting of five chapters, describes direct measurements of diameter, height, volume, and age of trees, the specialized instruments or tools needed, and their use. Part II, called "Direct Estimate by Sampling," also consisting of five chapters but occupying twice as much space, is devoted to interpretations of statistical constants, their reliability and application. It contains an excellent discussion of simple sampling and of the normal curve.

Part III, which deals with indirect estimate based on one or more independent variables, places the emphasis on curve fitting, both free-hand and by the method of least squares, on correlation methods and on the nature and behavior of the related factors in general. It also contains a very clear exposition on the preparation and use of alignment charts. This part comprises 46 per cent of the book, as it deals with the most important problems of forest mensuration.

Part IV describes methods of prediction of growth and yield. It discusses cyclic variation in growth trends, growth of even-aged stands, and also the growth of all-aged stands in contrast with the former. The discussion on growth of even-aged stands and preparation of yield tables is very clear and complete. The growth of all-aged stands is treated rather sketchily and briefly, mostly because very little is known about such stands at the present time.

Although the book can be used as a reference by many a practicing forester, is was intended primarily for the college student. As a textbook it will bend the mental development of students toward scientific methods, increase their powers of inference, and help them later on to be cautious in drawing important conclusions.

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*Factor Analysis in the Study of Personality,* by John Clemans Flanagan. Stanford University Press, 1935. x, 100 pp.

The author sets forth the aims of this book in the opening paragraph of his preface as follows: "This monograph aims to give a critical review of factor theory and its development, including the very recent contributions of Thurstone and Hotelling; to develop a general technique for constructing tests to measure independent components directly; to provide a new method

for determining the values to be attached to individual responses, namely, an iterative method of solving for regression coefficients without computing intercorrelations; and to present two measures of independent components representing almost all the information contained in an original set of four variables." Several comments may be offered with reference to the objectives here outlined. Certainly the objectives are all useful and of current interest. The chief difficulty is that within the short scope of little more than one hundred pages, it is impossible to do justice to all of them. A thorough critical review of factor theory from Spearman's initial work to the most recent work of Thurstone, Hotelling, and Kelly would require a volume considerably greater than this one. It is unquestionably true, however, that any competent work in both the fields of factor analysis and personality is deserving of commendation.

In his review of factor theory, the author indicates both a technical familiarity with the methods and an appreciation of their scientific and philosophical implications. The author presents a factor analysis according to Hotelling's method on three sets of data. These three sets are all based on marks in college courses of instruction. Another factor analysis is presented on data from the Bernreuter personality schedule. Judging from the title of the book alone, one might suppose that the illustrative material would all be based on personality data.

In addition to the discussion and application of factor analysis technique, the author discusses a technique of item analysis. The treatment is interesting, and the technician interested in this line of work will, doubtless, wish to obtain more complete details about the method from the author. The method is used in obtaining two new sets of weights for the items in the Bernreuter schedule, these weights making it possible to obtain two independent scores on the Bernreuter inventory. One of these the author calls "self-confidence" and the other "sociability."

A mathematical appendix is presented to supplement the verbal treatment in the main body of the monograph. An extensive bibliography is included in the appendix.

The monograph is a most welcome variation from the usual sort of hackneyed experimental methods and theoretical generalizations which constantly appear under the name of educational and psychological contributions.

PAUL HORST

Procter & Gamble Company

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*Social Work Year Book, 1935.* Description of organized activities in social work in related fields. Third Issue. Editor, Fred S. Hall. New York: Russell Sage Foundation, 1935. 667 pp. $4.00.

*The Social Work Year Book* is primarily a reference book for social workers and as such is utterly indispensable. Its avowed purpose, which is a very laudable one, is to inform social workers concerning the variety of

organizations existing in the United States with programs planned around the care of important social economic needs. Structurally the *Year Book* is divided into two major parts. The first comprises an encyclopedia of descriptive articles on selected topics dealing with organized social work activities. The second is an excellent descriptive directory of "413 national agencies (public and private), 526 public state agencies, and 51 state-wide private agencies." Of the Directory, little needs be said. It is concise, informative, and complete enough for most reference needs and follows the same plan as the Directory in the two preceding volumes. The articles in the first part are, in the main, by persons well qualified to write authoritative, brief, uncritical descriptions of the organized activities in specific fields. The contributors have been asked "to avoid expressions of personal opinion, so far as possible, referring—where appraisal method is desirable—to the published or unpublished standards of representative groups." If it can be assumed that all the agencies represented can be relied upon to give accurate appraisals of their own programs, then the *Social Work Year Book* may well claim to be an authoritative record of organized activities.

Very few of the contributors to the *1935 Year Book* contributed to the preceding volume. This change is probably the most important innovation in the editorial policy of the publication. The social work profession is relatively a new one. It can hardly be said to possess a strictly delimited field, a consistent philosophy, or a uniform terminology. There is a great deal to be gained for the profession as a whole in having a large number of recognized professionals set down on paper descriptions of activities, problems, and programs with the hope that ultimately they will develop something tangible and stable that can be said to define social work. If the policy of changing contributors is followed in the succeeding volumes, it will further enrich the concepts of social work.

As it might be expected, there is a considerable consolidation of articles that appeared in the preceding volumes. The history of activities has been eliminated so that each activity is described in the light of its present organization and avowed program. The scope of the *1935 Year Book* has been considerably broadened. The current depression has had its effect in coloring the type of activity to be included and in placing an emphasis on public social work. Criticism can be made of the editorial policy, however, for continuing to show considerable restraint in emphasizing these factors of economic change upon the scope and trend of social work activities. To each article there is appended a very short but useful biography.

Special attention should be called to the articles by René Sand on "European Social Work" and by George L. Warren on "International Social Case Work." It is to be hoped that in the future such articles, which furnish almost the only basis in the book for comparing programs in the United States with those in other countries, will be enlarged. The article by René Sand contains a sentence which should stimulate a good deal of thinking on the part of American social workers: "The country (i.e., Russia) has no

group which can be called social workers because all professions are socially oriented."

RALPH CARR FLETCHER

Bureau of Social Research,
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*Répertoire International des Institutions Statistiques.* Office Permanent de L'Institut International de Statistique. La Haye. 1934. viii, 139 pp.
*Les Principales Sources de Documentation Statistique* par Jean Caumartin. Prefaces de M. Huber et de P. E. Dalbouze. Paris: Dunod. 1935. 38 pp.

The International Repertory of Statistical Institutions published by the Office of the Internationl Statistical Institute serves the useful purpose of supplying detailed information concerning the organization of statistical offices—international and national—and the publications issued by such offices. Among the international institutions listed, the statistical departments of the League of Nations, the International Labor Office, and the International Agricultural Institute occupy a foremost place. The information relating to governmental statistical activities covers 30 European, 8 African, 18 American, 10 Asian, and 3 Oceanian countries. It is interesting to note that in almost all industrialized countries—with the remarkable exceptions of Great Britain and the United States—the idea of centralizing the compilation and publication of statistical data in general statistical offices prevails as against the method of organizing special statistical services attached to administrative departments.

Attention may be drawn to the survey of municipal statistical offices. The standard set by Germany, where no less than 45 cities are equipped with statistical boards of their own, is no doubt worthy of imitation. The activity of the various governmental and municipal offices is illustrated by tables showing for each office the number of persons permanently or temporarily employed, the budget (relating to 1930–31), and the number of calculating machines used. Institutions created and maintained by national private corporations are included in the Repertory only in so far as they are engaged on the study of business cycles. In fact, in almost all countries in which business fluctuations have been made the object of current inquiries, this field of statistical analysis has been left to private institutions. A notable exception, of course, applies to Soviet Russia.

Considerable pains have obviously been bestowed on the compilation of the Repertory, involving comprehensive correspondence with many administrative agencies for the purpose of securing reliable and satisfactory data. In order that it may be kept abreast of the rather rapid development of administrative statistics, however, the Repertory stands in need of revised editions. Although, for manifest reasons, the survey can scarcely be expected to cover adequately the vast domain of non-official statistical institutions and their publications, the suggestion might be ventured that at least the

statistical reports and studies of certain bodies be included, as, for example, chambers of commerce and agricultural organizations, which, in many countries, are semi-official in character. A similar suggestion can be made concerning statistical associations, which, in almost all leading countries, play an important part in promoting statistical research and the discussion of methods of statistical analysis.

On purely national grounds the International Repertory is ably supplemented by Mr. Caumartin's compilation of the principal sources of statistical information available for France. It has been the author's intention primarily to assist business men in finding their way through statistical data and reports based on such data which they may need in managing their affairs. Hence the small volume is divided into two main parts, the first covering annuaries and general statistical publications and the second covering reports, studies, and periodicals that deal with special fields of statistics, such as agriculture, colonies, commerce, public finance, industry, labor, population, cost of living, and transport. In an appendix, international statistical annuaries and periodicals are listed along with the official national publications of the same type.

KARL PRIBRAM

The Brookings Institution

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*Lo Spopolamento della Francia,* by Giovanni Lasorsa. Milan: Dott. A. Giuffrè. 1934. x, 106, pp. Lire 15.

"Whither the French population?" Dr. Lasorsa asks. The answer, given in the concluding pages of his scholarly monograph, is: "toward extinction." "Extinction is the fate of the French people if they be forced to rely upon their own powers and if the present demographic situation is not improved."

This gloomy forecast is based upon a careful statistical analysis of a large array of demographic data, an even cursory examination of which reveals a number of significant facts. In 1801, the year in which the first regular census was taken in France, there were 904 thousand births from a population of 27.5 millions. In 1872, there were 966 thousand births from a population of 36 millions. In 1913, there were 746 thousand births, whereas the population amounted to 38.7 millions. In 1933, the population figure stood at 41.8 millions and that of births at 687 thousands. During the past century and a third, the French population thus increased by 52.3 per cent, whereas births diminished by 24.4 per cent; at the same time, the birth rate fell from a high of 33.9 in 1814 to a low of 16.3 in 1933 and the death rate from 29.8 in 1814 to 15.8 in 1933.

How can a population continue to increase while births consistently decline? The answer is, through immigration. "France," Dr. Lasorsa writes, "is being colonized by foreigners. From 1886 to 1931 the French population increased by 3.7 inhabitants per square kilometer. Of these 3.2 were foreigners."

What are the causes of the French demographic debacle? Among the most important are: the rapid increase in the standard of life of the French people since the middle of the last century (attributable to cost-reducing technological developments and to the exploitation of a large, newly acquired colonial empire); the consequent growth of neo-malthusian practices among the French masses and the resulting rapid "aging" of the French population, shown by the continuous increase in the percentage of older people (a phenomenon because of which France has been called Europe's "old people's home"); and, finally, the pronounced disequilibrium in the sexes (a considerable numerical superiority of women), clearly noticeable in the ages of greatest fecundity. A combination of these factors has brought into being veritable "death areas" in France, areas in which immigration is small and in which there is a rapid and consistent decrease in numbers. In the 50 years from 1881 to 1931, there was a net decrease in population in 64 out of 87 French *départements*, a decrease which reached the impressive figure of 40.5 per cent in the department of Lot and of 50.2 per cent in the department of Tarn and Garonne. The causes for these alarming declines, aside from the general factors mentioned above, Dr. Lasorsa finds, were the rapid depopulation of the higher mountainous areas, in which entire communities were found to be dying out, and the gradual but ever progressing depopulation of the French countryside as a whole. Whereas in 1851 the rural population was 74.5 per cent of the country's total population, in 1926 it had declined to 50.9 per cent. In France, as in other countries, the modern metropolis grew and continues to grow at the expense of the village.

Although Dr. Lasorsa's work contributes little that is entirely novel or original (for years, and particularly since the publication, in 1911, of Jaques Bertillon's classic, *La Dépopulation de la France*, the decline in the French population has been a favorite topic of demographers), his monograph, which summarizes and brings up to date earlier information, is, on the whole, interesting and suggestive. Food for serious meditation is offered especially by the note of warning with which the volume ends: a plea to the French for greater fecundity if their race is to hold its own and an earnest appeal for the establishment of sound principles of international justice and cooperation that may allow nations to eliminate peacefully the frictions which inevitably are bound to arise from the demographic disequilibria that are becoming more and more pronounced on the continent of Europe.

A detailed statistical appendix, containing a number of interesting and at times laboriously prepared tables and charts (giving age distributions, birth and death rates, density of population, fecundity rates, number and distribution of the foreign-born, distribution of urban and rural population for the Republic as a whole as well as for individual *départements*), throws further light upon the various aspects of the phenomenon which the author discusses and considerably enhances the usefulness of his monograph.

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